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Soil Conservation Service

Economic Research Service

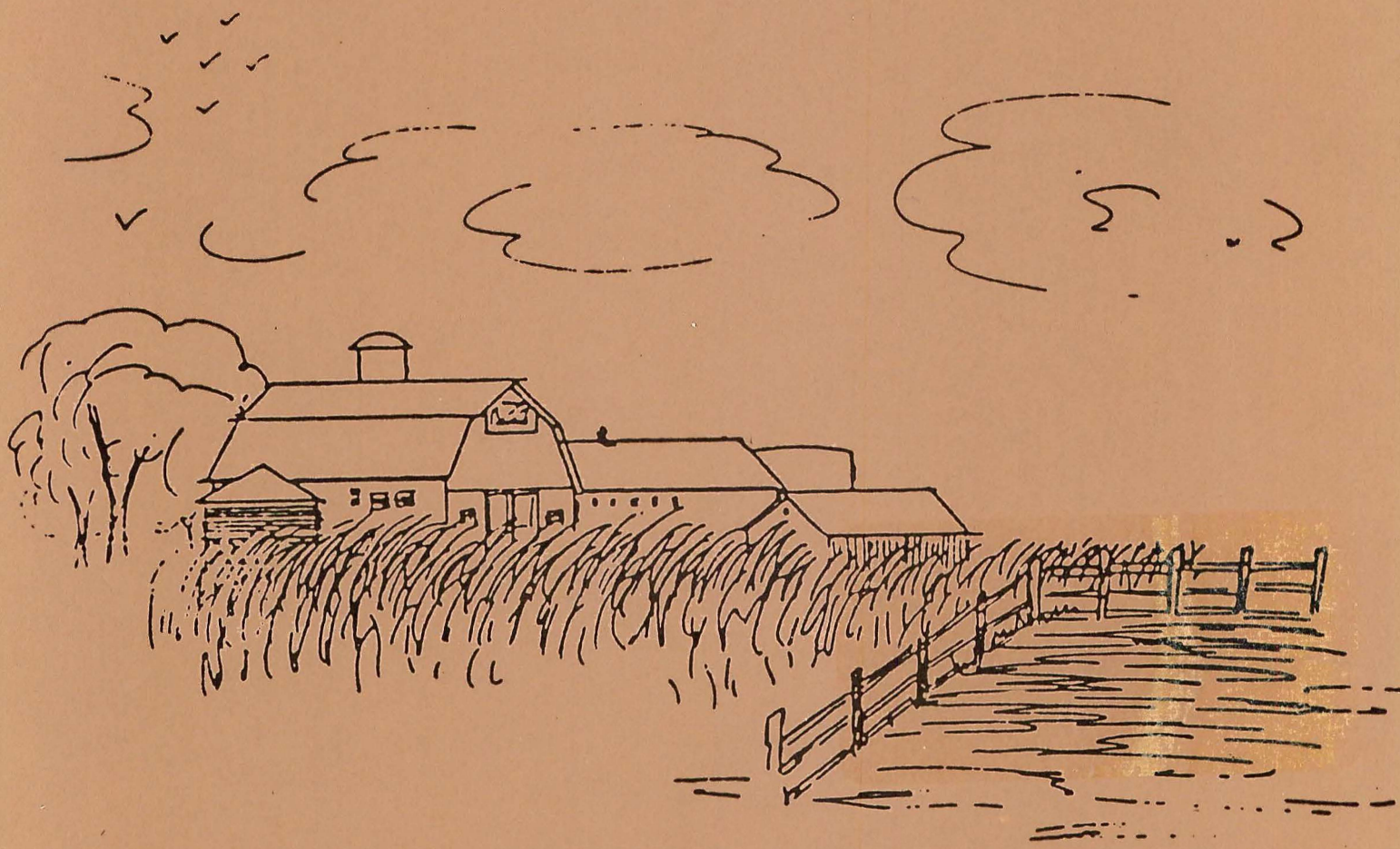
Forest Service

In cooperation with

State of Kentucky

Kentucky Special Resource Study

Main Report



KENTUCKY SPECIAL RESOURCE STUDY
on
WATER AND RELATED LAND RESOURCES
KENTUCKY

Prepared by

USDA River Basin Planning Staff
Soil Conservation Service
Economic Research Service
Forest Service

In cooperation with
Commonwealth of Kentucky
Kentucky Natural Resources and Environmental Protection Cabinet

Under Direction of
Field Advisory Committee
Lexington, Kentucky

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PREFACE

This report presents the results of a study of erosion, sedimentation, and related resource problems and concerns in the Commonwealth of Kentucky. The study was conducted by the Soil Conservation Service, Economic Research Service, and Forest Service of the U.S. Department of Agriculture in cooperation with the Kentucky Natural Resources and Environmental Protection Cabinet (KNREPC).

State agency representatives expressed need for the study to provide data that will assist decision-makers in coordinating federal and state programs, establishing project priorities, and promoting the development and conservation of the Commonwealth's water and land resources. Some of the state agency representatives were particularly interested in identifying erosion and related resource problems and alternatives for reducing their magnitude.

Authority

The study was conducted under the authority of Section 6 of the Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended. This act authorizes the Secretary of Agriculture to cooperate with other federal, state, and local agencies in their investigations of watersheds and designated areas to develop coordinated programs.

Participants

Principal USDA study participants included the Soil Conservation Service, Economic Research Service, and Forest Service. Participation of these agencies was carried out in accordance with assigned responsibilities and coordinated nationally through a Washington Advisory Committee and in Kentucky by a Field Advisory Committee. The Commonwealth of Kentucky participation in the study was conducted by the Division of Conservation of the Kentucky Natural Resources and Environmental Protection Cabinet.

Responsibilities

A USDA Field Advisory Committee, composed of a chairman from the Soil Conservation Service and a member each from the Economic Research Service and Forest Service, was responsible for coordinating and directing the study. Staff members from each of the three USDA agencies had responsibility for specific phases of the study elements including collecting and assembling data on resource problems and concerns; compiling and analyzing data to reflect the magnitude of the resource problems, natural and physical characteristics of the state, and economic conditions; and formulating and evaluating alternatives for reducing the resource problems.

The Division of Conservation of the KNREPC Coordinated the State's efforts and provided inputs. Representatives from this division participated in study meetings, secured data from other state agencies, and reviewed study outputs. Several state divisions, particularly the Division of Forestry and the Division of Water, provided data and assistance. Some of the others that provided data included the University of Kentucky, U.S. Army Corps of Engineers, and Soil and Water Conservation Districts.

Report Organization

This report consists of a summary, four chapters, and appendices. A summary follows that provides an overview of the study. The first is an introductory chapter, the second identifies problems and concerns, the third provides information on erosion and sediment reduction alternatives evaluated, and the fourth presents the major findings and conclusions. The appendices include a section highlighting the seventeen reference reports prepared as part of this study, a section on the resource base, and a section with supporting and reference data.

SUMMARY

This report presents the results of the Kentucky Special Resources Study conducted by the U.S. Department of Agriculture agencies in cooperation with the Kentucky Natural Resources and Environmental Protection Cabinet. The overall objective of the study is to provide data to assist in (a) identifying and assessing water and land resource problems and concerns, and (b) guiding the development, utilization, and conservation of the resources. Although consideration is given to nonagricultural resource problems, emphasis of the study is directed toward erosion, sediment, and related agricultural land use problems and concerns.

The Special Resources Study for Kentucky was requested by the Kentucky Department for Natural Resources and Environmental Protection Cabinet. Representatives of the Cabinet, along with other state department and division members, expressed need for the study to provide data that facilitates resource planning and development activities. These representatives also participated in selecting the resource problems and concerns to be addressed in the study.

The report is presented in two sections, the Main Report and the Appendices. The main report presents information on the resource problems and concerns, alternatives evaluated and findings and conclusions. The appendicies highlight the reference reports prepared as part of this study, provide data on the resource base, and contain supporting data for the study. The seventeen reference reports, printed separately from the main report, provide data on agricultural production, population, and economic conditions in the state, as well as additional data on resource problems and concerns. Copies of the individual reports can be obtained from the Soil Conservation Service, 333 Waller Avenue, Lexington, KY, 40504.

Location and Description

The Special Resource Study is for the state of Kentucky and covers 25,862,000 acres or 40,409 square miles. Kentucky has 25,196,900 acres of land and 665,100 acres of water. The land area consists of 22,866,200 acres classed as rural nonfederal land, 1,205,400 acres in urban and built-up areas, and 1,124,800 acres of federal land. As shown in the 1982 National Resource Inventory, rural land use includes about 26 percent cropland, 26 percent pasture, 44 percent forest, and 4 percent in farmsteads, mine, quarry, and related areas. Slightly over six million acres are classed as prime farmland.

Kentucky is in three Water Resource Regions - The Ohio River Region, the Tennessee River Region, and the Mississippi River Region. Topography in Kentucky varies from wide floodplains on the Ohio and Mississippi Rivers in the western section to rolling uplands in the central section, and rugged mountains in the eastern section. Elevations range from less than 300 feet above sea level along the Mississippi River in West Kentucky to over 4,000 feet in Harlan County near the Kentucky-Virginia border. Annual rainfall averages about 47 inches and mean annual temperature is about 56° Fahrenheit. The state's varied landscape and use of its resources have influenced the type and magnitude of the resource problems and concerns.

Problems and Concerns

The water and related land resource problems and concerns addressed in the statewide study include excessive soil erosion, sedimentation, land use changes, loss of prime farmland, and water quantity and quality. In 1982, sheet and rill erosion on Kentucky's 5.9 million cropland acres totaled 56.5 million tons for an average of 9.5 tons per acre. Soil erosion rates on about 70 percent of the state's cropland exceed acceptable soil loss limits of 3-5 tons per acre. The average erosion rate of 18.5 tons per acre in the Purchase Area, Major Land Resource Area 134, almost doubles the per acre erosion rate on cropland in Kentucky's other four MLRAs.

Erosion on Kentucky's 5.9 million acres of pasture amounts to about 16.8 million tons for an average per acre rate of 2.9 tons. MLRA 125 in eastern Kentucky has the highest per acre rate of 6.1 tons. Erosion on 785,000 acres of rural land in farmsteads, mines, quarries, and related uses averages about 72 tons per acre and amounts to over 56 million tons. Most of this erosion occurred in MLRAs 125 and 120, the areas in which virtually all the coal mining is conducted. Other significant erosion sources are roadbank, streambank, and construction areas.

Principal sediment sources are surface mine, cropland, roadbank, streambank, and development areas. Sediment delivered off-site from these and other sources varies widely and ranges from over 50 tons per acre on newly distributed surface mine and development areas to less than one ton on cropland. Although all MLRAs have excessive sedimentation problems, the most noticeable ones are in Western Kentucky, particularly in the surface mining counties in MLRA 120.

Conversion of prime farmland for development purposes is becoming a concern and will be more so in the future. Principal areas of concern are near the larger populated areas of Louisville, Lexington, Covington-Newport, Owensboro, and Bowling Green. In addition to the expanding metropolitian areas, strip development along major highways is also consuming substantial acreage in rural areas.

Water supply and quality problems are predominantly seasonal shortages, inadequate local sources, inferior quality, and inadequate facilities for storage, treatment or distribution. Surface water supplies are important to the state since groundwater supplies are inadequate in many areas. Pollution problems are mostly related to surface water quality. The most noticeable pollutants are suspended sediment and sewage, industrial waste, and mining refuse in the streams.

Alternatives

The crop production alternatives presented in this report and in some of the reference reports are directed primarily toward reducing erosion and sedimentation problems. All alternatives consist of a conventional, conservation, or no till management system with different crop rotations and with or without conservation practices. Output from the evaluations identify the quantity of erosion and the relative level of monetary returns that could be expected from grain farming in Kentucky for different resource management systems.

Analyses of economic and soil conservation impacts of alternative resource management systems for Kentucky's Major Land Resource Areas are based on identification of representative resource management systems and establishment of homogeneous soil resource groups. The soil conservation impacts are analyzed by using the Universal Soil Loss Equation and assigning appropriate slope, cover, and related factors for each soil resource group and for each resource management system. Economic impacts are determined by identifying production imput costs, crop yields, and returns for each management system and soil resource group. 1/

The alternatives evaluated show that the no-till crop production method provides the most favorable net returns and reduces erosion below T (less than 3 to 5 tons per acre) on most of the erodible "e" soils. This tillage method along with conservation tillage also provides the most favorable net returns on the erodible "e" soils when erosion is greater than T (more than 3 to 5 tons per acre). On the nonerodible soil resource groups (1,2,3,14,15, and 16), conservation and conventional tillage are the most profitable crop production method.

1/ For more detail on the alternatives evaluated and methodology used in the evaluations, see reference report numbers 7,8, and 9.

CHAPTER I

INTRODUCTION

The Special Resource Study for Kentucky was conducted by the U.S. Department of Agriculture in cooperation with the Kentucky Natural Resources and Environmental Protection Cabinet. This study was made under the authority of Section 6 of the Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended. The Act authorized the Secretary of Agriculture to cooperate with other federal, state, and local agencies in their investigation of watersheds, rivers, and other waterways to develop coordinated programs.

Request for the statewide resource study was made by the Kentucky Natural Resources and Environmental Protection Cabinet. This Cabinet served as participating sponsors and coordinated study activities with other state and local agencies. Decisionmakers from the Cabinet and other state departments expressed need for the statewide study to provide resource data to facilitate coordinating federal and state programs, establishing project priorities, and promoting the development and conservation of the State's water and land resources.

Objectives

Principal objectives of the study are to provide data to:

1. Identify erosion, sedimentation, and related resource problems and concerns;
2. Indicate the quantity and use of the land and water resources; and
3. Assist in guiding the development, utilization, and conservation of the state's resources.

Study Area

The study area includes the State of Kentucky covering 40,409 square miles or 25,862,000 acres. The State, which has 120 counties, contains almost 22.9 million acres of rural nonfederal land, 665,100 acres of water, and 2.3 million acres of urban built-up and federal land. Rural land use consists of 26 percent cropland, 26 percent pasture, 44 percent forest, and 4 percent in farmsteads, mines, roads, and miscellaneous areas.

Kentucky is the northernmost state in the southeastern group of states, (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Virginia). It is bordered on the north and northwest by Ohio, Indiana, and Illinois. The state is joined by Missouri in the extreme western section, Tennessee in the south, and Virginia and West Virginia in the east. Kentucky contains part of three Water Resource Regions, including the Ohio River Region, the Tennessee Region, and the Lower Mississippi Region. Major Land Resource Areas in the state are, from east to west, the Cumberland Plateau and Mountains (125), Kentucky Bluegrass (121), Highland Rim and Pennyroyal (122), Kentucky and Indiana Sandstone and Shale Hills (120), and Southern Mississippi Valley Silty Uplands (134).[1/]

The State of Kentucky consists of three distinct sections, with each having different landscape features, resources, and economic activities that distinguish it from the others. The eastern section of the state is part of the Appalachian Plateau and is mostly a rugged mountainous area with narrow ridge tops, steep slopes, and entrenched valleys. This area is predominately forested, with coal, light industry, timber, and trade and service enterprises being the major economic activities. The central section of the state has varied topography, ranging from sloping, relatively steep hills, and narrow valleys in the southern and Knobs area to gently rolling lands in the Bluegrass portion. This section contains the larger population centers and the larger portion of the state's industrial, trade, and service enterprises. It has varied land use and diversified agriculture, consisting chiefly of cattle, grain, and tobacco farms. The western section of the state's topography varies from wide floodplains and gently rolling uplands to relatively steep, sloping hills in certain areas. It is predominately an agricultural grain producing area, with corn, wheat, and soybeans being the major crops. Manufacturing, trade, service, and coal are the principal nonfarm enterprises.

Study Management and Organization

The special resource study was conducted under the direction of USDA Field Advisory Committee composed of a chairman from the Soil Conservation Service and a member each from the Economic Research Service, and Forest Service. This Committee, which had the overall responsibility for the study, provided guidance to agency staff members in carrying out the following study phases:

[1/] In addition, a small section of the Southern Mississippi Valley Alluvium (MLRA 131), is in west Kentucky. For description of the Major Land Resource Areas, see Appendix B, pages 6-10.

1. Identification of objectives and preparation of plan of work.
2. Collection of data and inventorying resources.
3. Analyzing data.
4. Development and evaluation of alternatives.
5. Presentation of results and follow-up.

A plan of work detailing the work items in each study phase, agency responsibilities, and time schedule was used in conducting the study. Agency staff members were individually or jointly responsible for specific work items in each study phase.

The Director of the Division of Conservation of the Kentucky Natural Resources and Environmental Protection Cabinet represented the State in the management of the study. In addition to providing data and guidance, the state study representative solicited participation and data from:

Environmental Quality Commission
Nature Preserves Commission
Department of Agriculture
Department of Commerce
    Division of Tourism
Kentucky Natural Resources and Environmental Protection Cabinet
    Division of Abandoned Lands
    Division of Conservation
    Division of Forestry
    Division of Hazardous Material and Waste Management
    Division of Lands Unsuitable for Mining
    Division of Water
Department of Transportation

Representatives from these Departments or Divisions attended meetings and contributed certain inputs to the study. In addition, the State Department or Division members identified the following as the primary resource problems and concerns:

Excessive Erosion
Sediment Deposition
Water Quality (Pollution)
Water Supply Shortages
Major Resource Conflicts
Loss of Prime Lands
Need for Preservation of Wetlands
Excessive Flooding
Impaired Drainage
Fish and Wildlife Habitat Degradation
Distribution of Available Recreational Facilities
Lack of Available Sites to Dispose of Solid and Hazard Waste
Adverse Impacts of Waste Site Locations
Need for Land Use Data by Counties

The state sponsors and study participants selected the first set of the above problems and concerns to be addressed in the study.

Study Results and Use

The study provides a wide range of resource data that will assist decisionmakers and others in planning, developing, or redirecting programs for resource uses, setting priorities, and allocating funds. The data and results in the study will be useful to resource planners in identifying and evaluating alternative cropland rotations or systems to reduce erosion and to estimate income levels. The information and methodology presented, especially the soil resource groups, crop budgets, and soil depletion data, will be useful in developing conservation plans, conducting watershed protection studies, and setting priorities for funding.

Some of the information provided by the study includes:

1. Erosion rates on agricultural land by Land Capability Classes and by Major Land Resource Area.
2. Erosion data for roadside and other nonagricultural lands.
3. Estimates of the quantity of sediment delivered offsite from various land uses.
4. Information on water quantity and quality.
5. Current land use data reliable at the MLRA level for the state and at the county level for the Jackson Purchase Area.
6. Acreage of prime agricultural land by MLRA.
7. Data on alternative cropland management systems which would reduce erosion on agricultural lands characterized by excessive annual rates
8. Economic and other information in the main report and in the 17 reference reports.

CHAPTER II

PROBLEMS AND CONCERNS

The public and members of the state and local agencies have, in recent years, expressed an increasing concern over the availability, use and management of Kentucky's natural resources. While many citizens and agencies have a long standing concern for natural resources in the state and the nation, the increased awareness has been evidenced by actions taken by groups and agencies, such as the attendance at the Soil and Water Resources Conservation ACT (RCA) meetings held throughout the state. The public's response in the 1980 RCA appraisal and the responses from state sponsors were used to identify the problems and concerns to be addressed in this study.

Major problems and concerns selected to be addressed on a statewide basis are: 1/

1. Excessive erosion -- including sheet, rill, and gully.
2. Sediment deposition -- primarily from agricultural and forested lands.
3. Water quality and quantity -- mainly for agriculture use.
4. Land use and land use conversions -- principally change from agriculture land to nonagricultural uses.

In addition to the above problems and concerns, the study provides agricultural and related data that indicate other resource or use problems.

Information on the resource-based problems was obtained from the public and state personnel, 1982 National Resource Inventory, previously conducted natural resource studies, and other sources. The data are assembled and analyzed to reflect the relative magnitude and potential impact of the problems, principally on the agricultural industry. In addition, the data which highlight the different resource problems and concerns, are presented by state and by Major Land Resource Area, where applicable.

EROSION

Soil erosion is the most widespread water and related land-based problem in the state. It occurs on basically all disturbed and unprotected land. Sheet and rill are the most common types of erosion and they occur throughout most of the state. Sheet erosion is the removal of a relatively uniform layer of soil. Rill erosion usually consists of a series of shallow channels. The other types of erosion (gully, steambank, and roadbanks) are more localized.

1/ Appendix A provides a brief summary of reports prepared as a part of the Kentucky Special Resource Study which covers portions of the four major concerns.

Data in the 1982 National Resource Inventory (NRI) show that sheet and rill erosion on Kentucky's 12.6 million acres of rural (nonfederal) lands excluding forest land, totaled about 130 million tons (Table II-1). 1/ The annual erosion rate ranged from a low of 2.9 tons per acre on pasture to a high of 72 tons per acre on other land. 2/ The erosion data apply only to about 11.8 million acres of crop and pasture land and 785 thousand acres of other land. Federally owned land, urban, and built-up areas are not included in the resource inventory data.

The effects of soil erosion in the state are evidenced by the turbidity of sediment-laden streams, eroded and bare roadbanks, gullied and eroded farmlands, and sediment deposits on flood plains. In addition to the more noticable effects, soil erosion affects the productivity of agricultural lands, water quality, and environmental conditions.

Table II-1 - Summary of Estimated Annual Erosion on Rural Land 1/
Kentucky

Land Use	Area	Erosion	
		Total	Rate
	(acres)	(tons/yr)	(tons/ac/yr)
Cropland	5,934,200	56,537,300	9.5
Pastureland	5,879,800	16,838,800	2.9
Other 2/	784,800	56,654,800	72.2
Total or Weighted Average	12,598,800	130,030,900	10.3

1/ Excludes rural forest land

2/ Includes nonfederal rural land in farmsteads, farm roads, mining areas, gravel pits, etc. that are not in cropland, pasture land, forest, or urban and build-up.

Source: 1982 National Resource Inventory.

1/ Data collected as part of the 1982 National Resources Inventory (NRI) by the Soil Conservation Service of the U.S. Dept. of Agriculture under authority of the Soil and Water Resources Conservation Act of 1977 provide for appraisal of the National resources as designated by the act.

2/ See Footnote 1 of Table II-1 for explanation of other land.

Cropland Erosion

The state of Kentucky has almost six million acres of cropland. This is land used for the production of crops for harvest and may include grain, hay, nursery, orchard and specialty crops produced alone or in rotation with grasses and legumes. Sheet and rill erosion on all cropland averaged almost 9.5 tons per acre in 1982. The average of 9.5 tons per acre reflects a range of 2-3 tons for soils in Land Capability Classes I and II to a 35-38.5 ton rate in Classes VI and VII. Appendix C -Table 1 shows the estimated average annual erosion rate on cropland by Land Capability Class. 1/

Approximately 68 percent of the total cropland in the state is in Land Capability Class IIe through VIIe. Soils in a subclass designated "e" have an erosion limitation and are susceptible to excessive erosion when used for producing cultivated crops. Erosion on these soils accounts for almost 90 percent of the total amount occurring on cropland in the state. Aside from excessive erosion on land in Class VIs and VIIs, land in the other Capability Classes and subclasses do not erode excessively. 2/

About 80 percent of the 4.05 million acres of erodible "e" soils are in Class IIe and IIIe. The Class IIe soils are on moderate slopes (2-6 percent) and erode at an average of 6.6 tons per acre per year. Class IIIe soils are on 6-12 percent slopes and have an annual average erosion rate of 11.3 tons per acre. Soil erosion rates on steeper, sloping (12-30+ percent) lands in Classes IVe-VIIe average from 22 to 38 tons per acre per year (Table II-2).

Table II-2 - Cropland Acreage of Soils Having Erosion Limitations by Land Capability Class

Kentucky

Land Capability Class and Subclass	Total Area	Total Erosion	Average Erosion Rate
	(acres)	(tons)	(tons/acre/year)
IIe	2,078,800	13,730,000	6.6
IIIe	1,131,800	12,763,800	11.3
IVe	505,500	11,373,400	22.5
VIe	270,900	10,429,200	38.5
VIIe	68,700	2,133,900	31.1
Total or Weighted Average	4,005,700	50,430,300	12.4

Source: 1982 National Resources Inventory Data.

1/ Land Capability Class and subclass is a grouping of soils according to their potential and limitations primarily for sustained production of crops and pastures. For details, see Land Capability Classification, USDA, SCS, Agricultural Handbook 210, September, 1961.

2/ Subclass "s" soils have limitations of shallowness, stoniness, low moisture holding capacity or low fertility.

A review of the NRI data by Major Land Resource Area shows that most of the erosion on cropland occurs in the more intensive agricultural areas of west-central and western Kentucky. 1/ For example, data in Appendix Table 1.1 show that the Western Coalfields (MLRA 120), the Pennyroyal (MLRA 122), and the Purchase (MLRA 134) have 70 percent of the cropland on which almost 80 percent of the erosion occurs. The Purchase Area (MLRA 134), with about one-half as much cropland as MLRAs 120 and 122, has an average erosion rate of 18.5 tons per acre, double that of the other areas. MLRA 125 in eastern Kentucky has the least amount of cropland but the second highest erosion rate, 9.8 tons/acre/year.

The distribution of erosion on subclass "e" soils by MLRA reflects the type of crops grown and cropping practices used. For the less intensive grain producing MLRAs of 121 and 122, the erosion rate per acre increases as slope increases but much less than the intensively cropped MLRAs 120 and 134. The higher erosion rates in MLRAs 120 and 134 result from several factors, chiefly the more specialized cash grain farms, the erodible nature of the soils, and the cropping practices. Conversely, the lower erosion rates in MLRAs 121 and 122, particularly on the more sloping lands, can be attributed largely to the more diversified crop and livestock operations, crop rotations with grasses, and cropping practices. Table II-3 reflects the variation in erosion rates by MLRAs on the different subclass "e" soils having erosion limitations.

Table II-3 - Cropland Acreage and Erosion Data for Subclass "e" Soils by Major Land Resource Area

Kentucky

Major Land Resource Area	Total Area	Total Erosion	Erosion Rate
	(acres)	(tons)	(tons/ac/yr)
MLRA 120 (Western Coalfields)	751,200	12,859,100	17.12
MLRA 121 (Bluegrass)	1,187,400	7,535,600	6.35
MLRA 122 (Pennyroyal)	1,523,400	14,132,600	9.28
MLRA 125 (Eastern Ky. Mtns.)	187,200	3,390,300	18.11
MLRA 134 (Purchase)	406,500	12,512,700	30.78
Total or Weighted Average	4,055,700	50,430,300	12.43

Source: 1982 National Resource Inventory.

1/ Major Resource Areas (MLRAs) are geographically associated land resource units which are characterized by a particular pattern of soils, climate, water resources, and land uses.

Pastureland Erosion

Kentucky has almost 5.9 million acres of pasture land. This includes land used primarily for the production of forage plants for livestock grazing. Most of the pastureland is in the central section of state and on slopes of six percent or greater. Erosion is not generally excessive on properly managed and maintained pasturelands. In Kentucky, however, erosion exceeding desirable limits occurs on approximately one-third of the pasture acreage.[1/] Most of the excessive pasture erosion is on land with slopes of 20 percent or greater.

In 1982, erosion on the 5.9 million acres of pasture in Kentucky totaled over 16.8 million tons for an average of 2.9 tons per acre per year. By Land Capability Class, the rates vary from less than one-half ton per acre per year on the level to moderately sloping Class I and II lands to almost ten tons per acre on the steeper Class VII land (Appendix C -Table 1). Slightly over one-half of the pasture acreage is on Class IV -VII lands on which 87 percent of the total pastureland erosion occurs.

The major livestock producing areas in the state, MLRA 121 (Bluegrass) and MLRA 122 (Pennyroyal), contain 70 percent of all pastureland (Table II-4). These areas, with an average erosion rate of 2.5 tons per acre, account for 60 percent of the erosion on pastureland. The Mountains (MLRA 125), with 13 percent of the pasture acreage and 27 percent of the erosion, have the highest average erosion rate, 6.1 tons per acre per year. MLRA 120 (Western Coalfields) has the lowest average erosion rate of 1.5 tons per acre.

Table II-4 - Pastureland Acreage and Erosion Data by Major Land Resource Area
Kentucky

Major Land Resource Area	Total Acreage (acres)	Total Erosion (tons)	Average Erosion Rate (tons/ac/yr)
MLRA 120 (Western Coalfield)	816,600	1,188,400	1.5
MLRA 121 (Bluegrass)	2,441,000	6,632,300	2.7
MLRA 122 (Pennyroyal)	1,658,300	3,578,400	2.2
MLRA 125 (Eastern Ky. Mtns.)	755,100	4,610,600	6.1
MLRA 134 (Purchase)	208,800	829,100	4.0
Total or Weighted Average	5,879,800	16,838,800	2.9

Source: 1982 National Resource Inventory.

[1/] Because of the shallowness of most upland soils and other conditions, erosion rates exceeding 3 to 5 tons per acre are generally regarded in Kentucky as exceeding acceptable limits.

Overgrazing, inadequate cover, improper fertilization and lack of related management practices contribute to the excessive erosion rates. In addition, a significant portion of the pasture is on steep, sloping soils which have a low erosion tolerance. Erosion on these and other lands removes soil and suppress plant growth to reduce productive capacity of pasture.

Forest Land Erosion

Sheet and rill erosion on forest land was determined to be of minor consequence. However, excessive erosion results from grazing, wildfires and roads/trails associated with timber harvesting on all or portions of some woodland tracts.

Channel or gully erosion on forest land appears to be more of a problem than previously documented. Some gully erosion occurs over most of Kentucky. Contributing factors include soil piping, grazing, past land use, fragile soils, and forest land often occupying steep terrain. Also, water from roadways, fields and developed areas is often channeled into the woods. An assessment of thirteen individual watersheds distributed throughout Kentucky revealed channel erosion on forested portions of nine of the watersheds. Channel or gully erosion was estimated to account for 32 to 89 percent of the total forest land erosion volume in the watersheds. In addition to this range, the mean percent of total forest land erosion attributable to channels or gullies is 66 percent with a standard deviation of 17 percent and a coefficient of variation of 25 percent.

General erosion rates for major land resource areas in Kentucky are listed in Table II-5. In an effort to avoid extremes, only median rates are listed for each forest land condition.

Table II-5 - General Erosion Rates on Forest Land by Major Land Resource Areas

Kentucky

Erosion	Major Land Resource Area				
Forest Land	120 (Western) (Coalfields)	121 (Bluegrass)	122 (Pennyroyal)	125 (E. Ky.) (Mts.)	134 (Purchase)
	tons per acre per year				
Undisturbed forest	.05	.05	.05	.05	.05
Grazed woodland	.70	.70	.50	2.00	.70
Log haul roads		36.00	20.00	200.00	
Log haul roads and decking sites	20.00				
Developed (Constructed) skid trails				200.00	
Minimally constructed log haul roads and decking sites					.50
Continuous use skid trail 1/			20.00		
Mechanical site preparation	3.5		3.30		
General timber harvesting (felling, bucking, etc.)	.20	.10		.10	
General logging			.20		
Wildfire					
Wildfire (periodically burned over)				4.00	
Wildfire (regularly burned over)				8.00	
Forested mine spoil				2.75	
Natural erosion (steep slopes)				4.50	
Gullies	12.00	120.00	120.00	125.00	116.00

1/ Limited or no development/construction but numerous passes along same path to decking sites.

Source: Forest Service, U.S. Department of Agriculture

Gully Erosion

Gully erosion, while unevenly distributed, occurs throughout the state. The most extensive permanent type gully erosion is in the Purchase Area (MLRA 134), the Western Kentucky Coalfield Area (MLRA 120), and in the East Kentucky Mountains (MLRA 125). Permanent type gullies are more prominent on idle land, surface mined areas, unimproved pasture and harvested forest lands in sloping upland areas.

Ephemeral gully erosion on cropland occurs where overland flow concentrates. Although the ephemeral gullies are normally smoothed by tillage operations, a depression develops over time and the channels may become permanent gullies if not properly treated. Ephemeral erosion is more prevalent in the intensive grain producing section of west central and western Kentucky (MLRAs 134, 120 and part of 122) than elsewhere in the state.

The volume of erosion occurring from permanent and ephemeral gully erosion is not known. However, estimates indicate that gully erosion on affected crop areas may exceed the per acre rate of sheet and rill. In addition to soil loss, permanent gullies remove land from production, dissect the landscape, and increase crop production costs.

Roadside Erosion

Estmated erosion on road and railroad right-of-way areas in the rural section of the state exceeds 2.6 million tons annually.[1/] This includes erosion on all areas occupied by highways, roads and railroads located outside of urban and built-up areas. The road areas, including roadbeds and right-of-ways, occupy around 450,000 acres.

Erosion on road and railroad areas results largely from runoff on unstabilized, bare, sloping banks; unpaved roadbeds, unstabilized drainage ditches; and areas affected by construction. The average erosion rates range from over 250 tons per acre on highly eroding areas to one ton or less on those that are well vegetated and stabilized.

Data collected by SCS in 1982 show that almost 2,100 acres of highway, road, and railroad areas are eroding in excess of 200 tons per acre per year.[2/] About 40 percent of this acreage is in east Kentucky (MLRA 125), 38 percent is in the Pennyroyal (MLRA 122), 12 percent in the Western Coalfields (MLRA 120), 8 percent in the Bluegrass (MLRA 121), and only 2 percent in the Purchase (MLRA 134). Christian, Pike, Floyd, Meade, and Barren Counties were reported as having the most acres of eroding road areas and the highest erosion rates.

1/ From data collected in the 1982 National Resource Inventory.

2/ From data collected by Soil Conservation Service field personnel on road and railroad erosion as part of this study. For more detail, see reference report No. 16 on Roadside Erosion or the summary of the report in Appendix.

Other Land Erosion

According to data collected in the 1982 National Resource Inventory, Kentucky has about 785,000 acres of rural land that is not in crop, pasture, forest, urban built-up, or transportation areas. This acreage, classified as "other land" includes farmsteads, feedlots, quarries, strip-mines, and related areas. Two-thirds of the acreage in other land category is in MLRA 120 (Western Kentucky Coalfields) and MLRA 125 (East Kentucky Mountains), the areas in which most of the state's coal is mined.

Erosion on the other land totaled an estimated 56.6 million tons for an average of 72 tons per acre per year. The annual rates varied from less than one ton per acre on Class I land to 167 tons on Class VII lands (Appendix C -Table 1). As depicted in this table, over 70 percent of the erosion on the "other land", is in MLRA 125 and 20 percent is in MLRA 120.

The heavy erosion rates in the MLRAs 120 and 125 result largely from the newly disturbed and unstabilized surface mining areas. Virtually all the erosion, 97 percent, is on lands in Classes VI - VIII. Most of this acreage is in Class VII which has slopes of 30 percent or greater. Erosion rates on the remaining one-third of the total acreage of the "other land" in Capability Classes I -IV averaged 6.4 tons per acre per year.

CONSERVATION TREATMENT NEEDS

The magnitude of erosion in Kentucky is further reflected by the acreage of crop, pasture, and other land identified as needing conservation treatment. Land needing conservation treatment includes acreage having erosion and excess water (wetness) problems, being improperly managed or used, and possessing limitations that restrict use. Treatment needs may involve a change in land use or conservation-management practices to protect the land and water resources.

Kentucky has almost 12.6 million acres of nonfederal rural land that are in crop, pasture, and other uses (Table II-6). This includes 5.6 million acres that are adequately treated and almost 7 million acres needing conservation treatment. The land needing treatment includes about 3.1 million acres of cropland, 3.4 million acres of pasture, and 150 thousand acres in farmsteads, mines, and other rural land.

As depicted in Table II-7, the type of land treatment needs are influenced by land use and cover and the treatment may be for erosion control, protection, improvement, or management. On crop and other land in farmsteads, mines, and related uses, the dominant need is for soil erosion reduction. For pastureland, the major needs are for improvement and reestablishment of cover. These treatment needs are presented in more detail by MLRA in Tables 2 through 4 in Appendix C and in the following discussions by land use.

Cropland

On a statewide basis, 2.85 million cropland acres are adequately treated and 3.08 million acres need some type of conservation treatment. Of the acreage needing treatment, 88 percent needs erosion control practices, almost 12 percent needs drainage, and less than one percent need irrigation management. Some of the erosion control practices applicable are residue management, annual cover, sod in rotation, contouring, stripcropping, terraces, diversions, conservation till, no tillage or change in land use to permanent cover. Drainage needs include subsurface (tile) and surface (waterways and ditches) practices.

Erosion control treatment is needed in all MLRAs, with the largest number of acres being in MLRA 122 (Pennyroyal) and 120 (Western Coalfields). MLRA 125 (Mountains) has the least amount of cropland and the smallest percent of the area needing erosion control treatment. MLRA 134 (Purchase) has the highest proportion of the cropland acreage needing erosion control treatment. Most of the drainage needs are in MLRA 120 (Western Coalfields). Appendix C -Table 2 shows the type conservation treatment needed by MLRA.

Table II-6 - Acreage of Land Adequately Treated or Needing Treatment by Land Use, 1982 [1]

Kentucky

Land Use	Adequately Treated	Treatment Needed	Treatment Not Feasible [2]	Total
	acres			
Cropland [3]	2,854,700	3,079,500	[4]	5,934,200
Pasture land	2,438,100	3,405,900	35,800	5,879,800
Other	311,500	149,100	324,200	784,800
Total	5,604,300	6,634,500	360,000	12,598,800

[1] Includes rural nonfederal land only.

[2] Treatment Not Feasible - A conservation problem exists, but treatment is not feasible because a reasonable return on the investment is unlikely.

[3] Includes 5,917,900 acres of non-irrigated land, and 16,300 irrigated acres.

[4] The 1982 NRI data did not identify the cropland acreage on which treatment is not feasible.

Source: 1982 National Resources Inventory.

Table II-7 - Conservation Treatment Needs by Land Use, 1982

Kentucky

Conservation Treatment Need	Land Use			
	Cropland	Pastureland	Other Land	Total
	acres			
Erosion Control	2,712,800	244,400	143,400	3,100,600
Drainage	364,300	44,600	5,700	414,600
Protection	-	246,100	-	246,100
Improvement	-	2,218,500	-	2,218,500
Reestablishment	-	651,200	-	651,200
Irrigation Management	2,400	1,100	-	3,500
Total	3,079,500	3,405,900	149,100	6,634,500

Source: 1982 National Resources Inventory.

Pastureland

The inventory shows a total of 5,879,800 acres of pasture in the state. About 58 percent of the acreage needs treatment, 41 percent is adequately treated, and less than one percent is not feasible to treat (Table II-6).[1/] Approximately 67 percent of the pasture acreage needing treatment could be improved by following a recommended fertilization, weed control, and management program (Appendix C -Table 3). Nineteen percent of the pasture needs reestablishment, seven percent needs protection from overgrazing, and seven percent needs mechanical erosion control practices to dispose of surface runoff and reduce soil movement.

Most of the pasture acreage needing treatment is in MLRA 121 and 122, the major livestock producing areas of the state. These areas have 70 percent of the state's pastureland and 67 percent of the total acreage needing treatment. MLRA 125 (Mountains) has the highest proportion of the pasture acreage needing conservation treatment measures.

Other Land

The other land category in the National Resource Inventory includes 784,800 acres in farmsteads, mines, quarries, and other rural land. This land consists of 311,500 acres that are adequately treated, 324,200 acres on which treatment is not feasible, and 149,100 acres needing conservation treatment practices. Erosion control practices are needed on 143,400 acres and drainage on the remaining 5,700 acres.

About two-thirds of both the total other land area and acreage needing treatment are in MLRAs 120 and 125 (Appendix C -Table 4). These are the areas in which most of the coal mining is conducted in the state. These two areas also contain over 90 percent of the 324,200 acres that are not feasible to treat.

[1/] Treatment not feasible - even though a conservation problem exists, treatment is not feasible because a reasonable return on the investment is unlikely.

SEDIMENT

Sediment is primarily a transported product of runoff from water induced erosion. It consists mostly of soil particles, gravel, and rock. Principal sediment sources are surface mine, roadbank, streambank, agriculture, construction, and development areas. Excessive sediment yields from these sources cause channel filling, infertile deposits on flood plains, stream pollution, and decrease the storage capacity of water reservoirs.

The largest concentrated areas with excessive sedimentation are in the eastern and western Kentucky coal mining sections. In 1981, coal production in Kentucky exceeded 157 million tons. This included almost 80 million tons produced by underground mining, 45 million tons by strip mining, and 32 million tons by surface and/or strip mining. Production in eastern Kentucky (mostly in MLRA 125) totaled 117.9 millions tons and western Kentucky (primarily in MLRA 120) had 39.6 million tons. Some of the erosion, sedimentation, and acid mine drainage problems in these two MLRAs occur from underground mining but the most widespread problems are from surface mines.

Surface mining activites are estimated to have affected over 426,000 acres in Kentucky.[1]/ Approximately 37 percent of disturbed acreage has been reclaimed or does not have excessive erosion or sedimentation problems. The other 63 percent, or 266,000 acres, needs reclamation. This includes about 165,000 acres of unreclaimed land that is subject to the requirements of the 1977 Surface Mine and Reclamation Act (P.L. 95-87). The remaining 100,000 or more acres were mined prior to enactment of the reclamation law.

The quantity of sediment produced from the surface mining areas is directly proportional to the amount of erosion and runoff. While varying, the erosion rates range from over 100 tons per acre per year on newly mined areas to less than five tons per acre on reclaimed and stabilized sites. Likewise, the quantity of sediment transported by runoff from the surface mined areas vary widely. Sediment delivered from newly disturbed and unreclaimed surface mine areas to the first drainage receiving site is calculated at 25 -50 tons per acre per year. For partially stabilized areas, the delivery rate is in the 10 -20 tons per acre range. Reclaimed-stabilized areas contribute an average of about 1-2 tons per acre per year. On a statewide basis, it is estimated that surface mining areas contributed between 6-7 million tons of sediment annually to the first drainage receiving site.

Road and streambank areas are major sediment sources in the state. Erosion on road and railroad areas in the rural section of the state is estimated at 2.6 million tons annually. Although the quantity of sediment transported from the eroding road areas is not known, data in the First Approximation of Suspended Sediment (FASS) report (developed as part of this study) indicate that the delivery rates range from a high of 35-45

[1]/ Soil Conservation Service Survey conducted in July 1977.

tons per acre per year to less than one ton per acre.[1/] The median per acre rate was slightly above the seven ton level. These rates include an average of the sediment delivered downstream from surfaced and unsurfaced road beds, banks, and rights-of-way for all roads and railroads in the eleven watershed areas in the FASS study. It should be noted that the sediment delivery rates are representative for the watershed areas included in FASS study, but not necessarily for any region or the state.

The 1977 National Resources Inventory data for Kentucky shows that streambank erosion amounts to about 11 million tons annually. A large portion of the erosion enters the stream system as sediment and is carried in suspended form or deposited in stream channels, on banks, in reservoirs, and on floodplains.

Sediment is produced from most of the agricultural land, particularly the acreage used for row crop production. In 1982, sheet and rill erosion on Kentucky's 5.9 million acres of cropland amounted to 56.5 million tons. Erosion on 5.9 million acres of pasture totaled 16.8 million tons, making the total for agricultural land over 73 million tons. While the rate varies by site and area, estimates in the FASS study show that an average of about 18 percent of the crop and pasture erosion moves offsite as sediment. Using the 18 percent delivery rate, the quantity of sediment produced and delivered from eroding crop and pasture lands amount to over 13 million tons per year.

Erosion and sediment produced on construction and development areas are a persistent problem in many sections of the state. Since most of the construction and development activities involve earth moving and disturbing operations, erosion rates are generally excessive on most sites. Data collected as part of this study indicate that erosion on the excessively eroding construction areas exceed 125 tons annually. The higher erosion rates on construction areas are on sloping lands in eastern Kentucky (MLRA 125) and the Bluegrass Area (MLRA 121). On an average annual basis, approximately 2000 acres of construction and development areas are estimated to erode at excessive rates.

[1/] It should be noted that the quantity of sediment delivered from the different erosion sources discussed here varies widely and is influenced by factors such as size of drainage area, land use, cover, soil texture, rainfall intensity and duration, and length and degree of slope. Because of this and since most of the reference data on sediment deliveries are applicable to selected sites, only a general approximation of the quantity delivered downstream from the different sources are made. For additional information on sediment delivery rates, see (1) Source Distribution of Sediment by First Approximation of Suspended Sediment (FASS) Procedure, a report prepared as part of the Kentucky Special Resources Study and (2) Soil Erosion and Sedimentation, a report prepared by Division of Water, Kentucky Natural Resources and Environmental Protection Cabinet, Sept. 1984.

Sediment delivered from the eroding construction areas which vary by area and site is estimated to range from 10 to 80 percent of the erosion volume. Limited observations in the First Approximation of Suspended Sediment Study show around 50 percent of the erosion is delivered downstream as sediment.

The more noticeable agricultural damages from sediment are infertile deposition, channel filling, swamping or ponding, and pollution. Sediment deposition damage to growing crops results from sediment laden floodwaters depositing silts or clays on crop leaves and grasses. Land damage is from deposition of coarser materials and infertile sand and gravel. Swamping or ponding results from accumulated sediment desposits in stream channels and on bottom lands that retard run-off and impede drainage. In addition, sediment deposition in stream channels and reservoirs decreases the storage capacity, increases flooding, results in added clean out and maintenance costs, and inhibits the use of recreational water.

LAND USE

The 1982 National Resource Inventory data shows Kentucky with 25,862,000 acres of surface area (Table II-8). Crop, pasture, and forest lands with 21,972,200 acres accounted for 85 percent of the total area. Urban, built-up, and other lands amounted to 2,099,900 acres or 8 percent of the area. Water with 665,100 acres and federal land with 1,124,800 acres accounted for the remaining 7 percent of the state's area.

Approximately 90 percent of the state's 25.2 million acres of land is classed as rural nonfederal land. Use of the 22,866,200 acre rural nonfederal land includes 5,934,200 acres of crop, 5,879,800 acres of pasture, 10,158,200 acres of forest, and 894,000 acres of other land. The other land includes farmsteads, feedlots, fence rows, ditch banks, mines, quarries, highways, roads, and miscellaneous areas.

Agricultural crop, pasture, and forest lands are distributed throughout each Major Land Resource Area, but not proportionally. The grain producing MLRAs, 134, 120, and 122, in west central and western Kentucky have the highest proportion of the area in cropland (Table II-9). These MLRAs have less than one-half of the rural land area but have 70 percent of the state's cropland acreage. The pasture acreage is concentrated mostly in the major livestock producing areas, MLRA 121 and 122. These two areas have 45 percent of the total land area and 70 percent of the pastureland. MLRA 125 in eastern Kentucky contains over one-half of the state's 10.2 million acres of forest land. Almost 80 percent of the 6,667,000 acre land area in MLRA 125 is forested. Approximately two-thirds of the acreage of other land is in MLRA 120 and 125, the areas in which coal mining occurs.

Table II-8 - Major Land Uses in Kentucky in 1982

Kentucky

Land Use	Area	
	(acres)	(percent)
Nonfederal Land		
Cropland	5,934,200	22.9
Pastureland	5,879,800	22.7
Forest Land	10,158,200	39.3
Other	894,000	3.4
Urban, Built-up	1,205,900	4.7
Federal Land	1,124,800	4.4
Water	665,100	2.6
Total Land and Water	25,862,000	100.0

Source: 1982 National Resource Inventory.

Table II-9 - Land Use of Rural Nonfederal Land by Major Land Resource Area

Kentucky

Major Land Resource Area	Land Use				
	Cropland	Pasture	Forest	Other	Total
	acres				
MRLA 120 (Western Coalfields)	1,559,500	816,600	1,465,400	247,500	4,089,000
MRLA 121 (Bluegrass)	1,365,700	2,441,000	1,115,100	104,800	5,026,600
MRLA 122 (Pennyroyal)	1,840,600	1,658,300	1,979,600	121,600	5,600,100
MRLA 125 (Eastern Ky. Mtns.)	396,700	755,100	5,262,600	263,500	6,677,900
MRLA 134 (Purchase)	771,700	208,800	335,500	40,700	1,356,700
Unallocated 1/	-	-	-	115,900	115,900
Total	5,934,200	5,879,800	10,158,200	894,000	22,866,200

1/ Includes 115,900 acres not distributed by MLRA.

Source: Compiled from 1982 National Resource Inventory.

Land Capability Classes

Land Capability Classification is a system used to show the suitability of soils for agricultural production.[1/] This system utilizes three basic categories for grouping soils: capability class, subclass, and unit. The broadest category, capability class, is used for grouping soils into eight different classes according to limitations and risks which affect use. The risks of soil damage and limitations in use are progressively greater from Class I through Class VIII.

In Kentucky, approximately 85 percent of the cropland is on the level to moderately sloping Class I, II, and III lands (Table II-10). Except for Class VIII, all land classes are used for pasture production. Most of the forest is on steep, sloping lands in the higher capability classes.

Capability subclasses are used for grouping soils having similar limitations or hazards. The hazards or limitations recognized in Kentucky include erosion, designated by the letter "e", wetness by "w", and shallowness or stoniness by "s". Approximately 68 percent of the cropland in the state is in the erosion "e" subclass, 19 percent in the "w" subclass, 2 percent in the "s" subclass, and 11 percent has no significant limitation or hazard. Compared to cropland, about 75 percent of all land in the state is in the "e" subclass, 8 percent in the "w", 12 percent in the "s", and 5 percent has no limitation.

Capability units, the smallest division, are groups within the subclass. The units are used to designate soil groups adapted to specific cultivated crops or pasture plants and require similar management practices. Capability units are reflected by numbers, usually 1 through 20. These units, which are excluded from Table II-10, are not widely used in Kentucky.

1/ "Land Capability Classification", Agricultural Handbook No. 210, Soil Conservation Service, U.S. Dept. of Agriculture, Sept. 1966.

Table II-10 - Land Use for Rural Nonfederal Land by Land Capability Class

Kentucky

Capability Class and Subclass	Major Land Use and Acreage 1/					
	Cropland	Pasture	Forest	Other 2/	Total	Percent of Total
	acres					
I	647,600	294,600	141,000	22,000	1,105,200	4.8
IIe	2,078,800	984,900	231,700	146,100	3,441,500	15.0
IIw	651,300	194,500	150,000	34,500	1,030,300	4.5
IIs	42,300	37,000	32,000	900	112,200	.5
IIIe	1,131,800	1,263,500	551,000	78,000	3,024,300	13.2
IIIw	441,900	104,600	170,400	21,900	738,800	3.2
IIIs	5,200	1,300	12,500	-	19,000	.1
IVe	505,500	906,900	841,300	50,700	2,304,400	10.0
IVw	37,500	17,600	24,900	1,700	81,700	.4
IVs	4,500	12,300	2,300	-	19,100	.1
V	700	7,500	9,200	1,200	18,600	.1
VIe	270,900	1,045,000	1,380,000	34,500	2,730,400	12.0
VIs	30,400	235,300	206,700	66,900	539,300	2.4
VIIe	68,700	566,400	4,723,400	167,900	5,526,400	24.2
VIIs	17,100	208,400	1,672,300	143,300	2,041,100	8.9
VIIw	-	-	9,500	1,900	11,400	.1
VIII	-	-	-	13,300	13,300	.1
Other 3/	-	-	-	109,200	109,200	.4
Total	5,934,200	5,879,800	10,158,200	894,000	22,866,200	100.0

1/ Compiled from the 1982 National Resources Inventory data.

2/ Includes farmstead, feed lot, ditch bank, fence, mine, quarry, highway, road and miscellaneous lands.

3/ Includes 109,200 acres of other land that are not distributed by Land Capability Class.

Prime Farmland

This is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oil seed crops. In 1982, Kentucky had over six million acres of Prime Farmland. This included 3,757,000 acres of cropland, 1,505,600 acres of pasture, 615,800 acres of forest, and 172,300 acres of other land. By Land Capability Class, 18 percent of the prime farmland is in Class I, 72 percent is in Class II, and 10 percent in Class III (Table II-11).

Prime Farmlands are distributed throughout the state, but the acreage is concentrated more in the western and west central section. MLRA 134 (the Purchase) in the extreme western part of the state has the highest percentage (56 percent) of the total area classed as prime farmland. MRLAs 120 and 122, with over 1.7 million acres each, have the largest acreage of prime farmland. MLRA 125 in eastern Kentucky has the lowest percent of the area and the least amount of acres classed as prime farmland (Appendix C -Table 5).

Counties having 150,000 or more acres of prime farmland are Christian, Graves, Logan, Henderson, Daviess, and Hopkins (Appendix C -Table 6). Nine additional counties have over 100,000 acres of prime farmland. All of these counties are in MLRAs 120, 122, and 134 in the west central and western portions of the state.

Table II-11 - Prime Farmland by Land Use and Land Capability Class

Kentucky

	Land Capability Class			
Land Use	I	II	III	Total
	----------acres----------			
Cropland	647,600	2,707,700	401,700	3,757,000
Pasture	294,600	1,148,100	62,900	1,505,600
Forest	141,000	367,300	107,500	615,800
Other	22,000	132,300	18,000	172,300
Total	1,105,200	4,355,400	590,100	6,050,700

Source: 1982 National Resource Inventory

Prime Forest Land

Kentucky has an estimated 5.77 million acres of prime timberland.[1/] This includes land that has soil capable of growing wood at the rate of 85 cubic feet or more per acre per year under proper management (at culmination of mean annual increment), in natural stands and not in urban or built-up land uses or water. This definition and related production criteria along with appropriate soils information were used to identify the acreage of prime timberland. In addition to the 5.77 million acres of forest land classified as prime timberland, the study indicates that about 6.6 million acres of nonforest land meets the prime timberland production criteria.

Land Use Changes

Land use changes and shifts may be illustrated by using two data sets -the 1967 Conservation Needs Inventory and the 1982 National Resource Inventory. Some definition changes were made, but those for the major land uses are essentially the same.

In 1967, crop, pasture, and forest lands amounted to 22.7 million acres, 88 percent of the total area in the state (Table II-12). By 1982, these uses had decreased to under 22 million acres, or to 85 percent of the state's total area. The acreage of cropland decreased by 9.9 percent and forest land decreased by 7.5 percent during the 15 year period. Pastureland acreage increased 13.8 percent above the 1967 level. All land uses in the other areas increased, with over 500,000 acres going to urban, built-up, and other uses. Water areas increased almost 42 percent, from 469,316 acres in 1967 to 665,100 in 1982. An additional 77,384 acres went into federal ownership during the 15 year period.

The change in "major" land uses has been paralleled by an increase in the acreage of crops planted. For example, the acres of principal farm crops planted increased from 3.6 million acres in 1967 to over 6.0 million in 1982 (Table II-13).[2/] This included a 2,154,000 acre gain in grain crops, 280,000 more acres of grass and legume hay, and 68,000 more acres of burley tobacco.

1/ For more detail, see Kentucky Prime Timberland Study conducted by the Division of Conservation, Dept. of Natural Resources, KNREPC as part of the Kentucky Special Resources Study.

2/ It should be noted that the acreage of crops planted exceed the acres of land classed as cropland in the 1982 National Resource Inventory. This is partially explained by the number of acres of wheat and soybeans that are double cropped; that is two crops harvested from the same acreage in the same year.

Barley, alfalfa hay, and dark tobacco acreage decreased by 31,780 acres, resulting in a net gain of 2,470,000 crop acres from 1967 to 1982. The total crop acreage increase of 2.47 million acres translates into an average gain of almost 165,000 acres per year during the 15 year period. Most of the 2.47 million acre increase in crop acres resulted from shifting rotational hay and pasture to crops and from converting idle land to crop production.

The shift to grain crops, especially corn and soybeans, makes the land more vulnerable to erosion. Since some of the crops are produced on sloping, highly erodible soils and by using conventional tillage practices, the erosion problems are rather severe and widespread. To reduce erosion, farmers are using improved production techniques and conservation systems or practices such as minimum and no-till, double-cropping, and contour planting. While accomplishments have been significant, erosion continues to be a major problem, resulting mostly from the large number of acres shifted to grain crops in recent years.

Table II-12 - Land Use Changes from 1967 - 1982

Kentucky

Land Use	Year 1967	Year 1982	Land Use Change (1967 - 1982)	
	(acres)	(acres)	(acres)	(percent)
Cropland	6,586,739	5,934,200	-652,539	-9.9
Pastureland	5,164,880	5,879,800	+714,920	+13.8
Forest	10,988,166	10,158,200	-829,966	-7.5
Subtotal	22,739,785	21,972,200	-767,585	-3.6
Water	469,316	665,100	+195,784	+41.7
Urban, Built-up and Other Land	1,596,283	2,099,900	+503,617	+31.5
Federal Land	1,047,416	1,124,800	+77,384	+7.4
Subtotal	3,113,015	3,889,800	+776,785	+0.4
Total Land & Water	25,852,800	25,862,000	+9,200 1/	+0.4

1/ Improved measurement of total surface area of the state accounts for subtotal and total differences between 1967 and 1982.

Source: Compiled from 1967 Conservation Needs Inventory and 1982 National Resource Inventory.

Table II-13 - Acreage of Major Crops Produced in Kentucky in 1967 and 1982

Kentucky

Crop	Year		Change
	1967	1982	1967 - 1982
	----------acres---------		percent
Corn	1,296,000	1,680,000	+29
Soybeans	388,000	1,680,000	+433
Wheat	300,000	750,000	+250
Barley	47,000	34,000	-28
Sorghum	20,000	48,000	+240
Alfalfa Hay	241,000	225,000	- 7
All Other Hay	1,100,000	1,380,000	+25
Tobacco			
Burley	157,000	225,000	+43
Dark Air Cured	16,000	13,220	-17
Total	3,565,000	6,035,220 1/	+69

1/ Since some grain crops, particularly soybeans and wheat, were double cropped in 1982 (grown on the same acreage in a given year), the total reflects the acreage of crops but exceeds the total acreage of cropland used annually.

Source: Data compiled from Kentucky Agricultural Statistics, USDA Statistical Reporting Service, Louisville, KY, 1967 Conservation Needs Inventory, and 1982 National Resource Inventory.

In addition to cropland use changes, the shifts of agricultural land to nonagricultural uses have become a concern to many in Kentucky. From 1967 to 1982, over 767,000 acres of crop, pasture, and forest lands were converted to other uses. This conversion represents a 3.4 percent decrease in agricultural land or a loss in excess of 51,000 acres per year for the fifteen year period. Of the 767,000 acres converted to nonagricultural uses, 65 percent went to urban, built-up, and other areas, 25 percent to water areas and 10 percent to public lands.

The land converted to nonagricultural uses includes some of Kentucky's most productive farmland. Although the actual amount of prime farmland converted to all uses is not readily available, estimates indicate that an average of 12,000 or more acres are lost each year.[1/] Using this annual rate, prime farmland amounted to 180,000 acres or 24 percent of the 767,000 acres of agricultural and forest land converted to nonagricultural uses between 1967 1982.

A wide range of factors and activities have influenced the conversion of agricultural land to nonagricultural uses. Some of the more apparent include the increase in population in urbanized areas, industrial activities, institutional and service establishments, and in subdivisions and shopping centers constructed on the outskirts of cities and towns. Since the return from selling land for development and expansion of these and related activities far exceed that of farming, agricultural land continues to be converted to nonagricultural uses. In view of the higher production costs and lower product prices, the conversion of land from farm to nonfarm uses will likely continue and may accelerate.

The short term effects of the loss of farmland, while felt locally, have been largely offset at the regional and statewide basis by the increase in agricultural productivity. However, as production costs continue to increase, the effects from reducing the agricultural land base, especially from the loss of prime farmland, could (1) deter the development of large-scale commercial grain production, (2) impede the use of large contiguous tracts of land needed to reduce per unit costs, (3) force farmers to shift production onto more marginal lands, and (4) pressure operators to use the land more intensively. All of these have the potential of increasing erosion and related land use problems.

1/ USDA Soil Conservation Service. The Kentucky Outlook. SCS, Lexington, KY, August, 1981.

WATER RESOURCES

Water Quantity

The State of Kentucky has an average annual precipitation of 47 inches with about 19 inches of runoff. This quantity is normally sufficient to replenish supplies in reservoirs and underground storage, and to maintain stream flows. However, droughts and water shortages occur because of seasonal variation and uneven distribution of rainfall, resulting in low stream flows, decreased reservoir levels, and inadequate soil moisture.

Kentucky has over 665,000 acres of surface water in reservoirs and streams. The surface water is estimated to provide 78 percent of the supplies used for municipal, industrial, and agricultural purposes. 1/ While groundwater only provides 22 percent of the domestic water, it is an important source, especially in rural areas where surface water is not available or economical.

Agriculture crop and livestock water supply problems are largely concerned with the availability and distribution. The average annual rainfall of 47 inches, if evenly distributed by area and time intervals, is adequate for most crops produced in Kentucky. However, prolonged periods with little to no rainfall do occur and crop and pasture yields are reduced and livestock water becomes limited in some areas.

Water Quality

Water quality in Kentucky varies by area and by season and depends largely upon local geological conditions, streamflow characteristics, and quantity of waste water and effluent material discharged. The most significant and widespread natural pollutants are sediment and dissolved minerals. Man's activity also contributes soluable materials to water. This pollution consists primarily of waste discharges from 1) domestic, industrial and agricultural uses, and 2) sediment, disssolved minerals, and diffused wastes in runoff from urban, industrial, mining, agricultural, and forest lands. Changes in stream regimen from upstream water retardation or diversion facilities, erosion control measures, fertilization, and irrigation could increase the concentration of materials to affect water quality.

1/ National Water Summary for 1984, U.S. Geological Service, water supply paper no. 2275.

The quality of water in many of Kentucky's smaller streams and reservoirs is good and suitable for most uses even though affected by turbidity after heavy rainfalls and concentrations of dissolved minerals during low flows. The smaller streams and reservoirs are distributed throughout the state, but the highest proportion having good water quality is in the vegetated sections of the Cumberland, Green, and Salt River Basins. Most of the smaller streams and reservoirs also are in areas unaffected by major urban, industrial, mining, and agricultural developments. The quality of water in many of the states larger streams and reservoirs, like the small ones is rated as good.[1]/ While affected by containments, particularly during low flow periods, the base stream flow or reservoir capacity is generally sufficient to assimilate the residual materials. Major rivers considered as having good water quality include the Upper Cumberland, Green, and Tennessee. The quality of water on the other rivers was rated as fair or it was not known. Several large tributaries of these and other major rivers in the state, especially in the less intensive industrialized or agricultural areas, also have good quality water.[2]/

Water quality problems caused by animal waste discharges and by the use of pesticides in agricultural operations have been reported in the state. The animal waste problems were caused by discharges from dairy, hog, and poultry operations. Discharges from these operations resulted in polluted water and some fish kills. Although pesticides are used extensively in agricultural crop production, no significant pollution or fish and wilflife problems have been attributed to their use (Appendix A -Report 1).

1/ Source: KNREPC, Division of Water. Kentucky Report to Congress on Water Quality, Frankfort, KY, June, 1982.

2/ While depending upon use, water quality is considered good or satisfactory if it satisfies the U.S. Public Health Service standards and the criteria in the State Water Quality Regulations (401 KAR 5:026 and KAR 5:031).

CHAPTER III

ALTERNATIVE RESOURCE MANAGEMENT SYSTEMS FOR CROPLAND

Introduction

Analyses of economic and soil conservation impacts of alternative resource management systems by soil resource group for Major Land Resource Areas 120, 121, 122, and 134 were jointly conducted by USDA's Economic Research Service and Soil Conservation Service. The purpose of the analyses is to provide state, regional, area, and district level agriculture and resource planners with short and long-term economic and erosion information for policy and decision making.

This chapter is presented in four sections. The first section outlines the information base, i.e., the data and methods employed to develop soil resource groups and resource management systems. Section two describes the methods of analyses - Universal Soil Loss Equation for erosion rate calculations, partial enterprise budgeting for short-term economic impacts, and soil depletion estimates for long-term physical and economic impacts. Section three includes an evaluation of physical and economic impacts of the alternative resource management systems by Major Land Resource Area.[1/] The last section contains a summary of results with recommendations for short and long-term agriculture planning.

SECTION I - INFORMATION BASE

Soil Resource Groups

The soils in Kentucky are placed into 16 soil resource groups (SRGS). Each group consists of soils having similar texture, slope, soil loss tolerance (T) level, erodibility (K) factor, erosion phase, drainage condition, and productivity index. Table III-1 provides a general description of each soil resource group and Table III-2 shows the acres of land in the groups by Major Land Resource Area (MLRA).

The soil resource groups provide the basis for the economic and soil conservation impact analyses conducted in this study. These groups are used in evaluating the impacts of different resource management systems on erosion rates and net returns for the principal grain crops produced in Kentucky. All alternatives evaluated are presented by soil resource group and contain crops produced on a continuous or rotational basis using no-till, conservation, or conventional tillage methods with and without conservation practices. The crop rotations, tillage methods, and conservation practices included in the alternative resource management systems are common and represent those used in the state.

1/ A 12 percent interest rate is used to calculate the annual costs included in the alternatives evaluated.

Soil conservation impacts are analyzed using the Universal Soil Loss Equation factors, Rainfall (R), Erodability (K), and Slope -Length (LS), for each soil resource group and the Cover (C) and Practice (P) factors for each resource management system. 1/ Since the groups contain different soils, weighted averages based on acreage for the USLE factors (T,K,L,S) are used in calculating the erosion rates for SRGs by MLRA. The Cover (C) and Practice (P) factors used are based on the method of tillage, rotation, or erosion practices.

The soil resource groups are divided into subgroups to facilitate conducting a more detailed impact analyses in MLRA 134 (Jackson Purchase Area). Six subgroups used in this MLRA are based on three erosion phases (slight, moderate, severe) and two management levels (basic, high). The erosion phases are used to represent SRGs in different stages of soil depletion with appropriate yield adjustments. Management levels used represent different yields levels which may result from intensified and/or better use of production inputs such as fertilizers and pesticides. Expected crop yields, which vary by SRG, subgroup, tillage method, and drainage condition, are developed for SRGs 1-11, 14, 15, and 16. Due to poor potential for agricultural production and high potential for excess erosion, SRGs 12 and 13 were not considered for economic and soil conservation impact analyses.

1/ For additional information on the Universal Soil Loss Equation factors (A,R,K,LS,C,and P), see Appendix C, pages 31 - 36 and page III-8 of this chapter.

Table III-1 - Soil Resource Group Descriptions for Kentucky Major Land Resource Areas

Soil Resource Group	Description
1.	Deep, well drained bottom, upland and terrace soils with 0-2% slopes, having a corn yield potential of 125-140 bushels per acre.
2.	Deep, moderately well and well drained bottom and terrace soils, having a corn yield potential of 110-125 bushels per acre.
3.	Deep, to moderately deep, well drained to excessively drained bottom and terrace soils, having a corn yield potential of 95-110 bushels per acre.
4.	Deep, well drained terrace and upland soils, having a corn yield potential of 120-135 bushels per acre.
5.	Deep, to moderately deep, well drained to moderately well drained upland and terrace soils, some with fragipans, having a corn yield potential of 100-115 bushels per acre.
6.	Deep, well drained terrace and upland soils, some with fragipans, having a corn yield potential of 105-120 bushels per acre.
7.	Deep to moderately deep, moderately well and well drained terrace and upland soils, some with fragipans, having a corn yield potential of 85-100 bushels per acre.
8.	Well drained and moderately well drained severely eroded terrace and upland soils, on 6-12 percent slopes, some with fragipans, having a corn yield potential of 60-75 bushels per acre.
9.	Well drained and moderately well drained, severely eroded terrace and upland soils with 6-12 percent slopes, some with fragipans, having a corn yield potential of 55-70 bushels per acre.
9A.	Well drained and moderately well drained, severely eroded terrace and upland soils with 6-12 percent slopes, some with fragipans, having a corn yield potential of 40-55 bushels per acre.
9B.	Well drained and moderately well drained, severely eroded terrace and upland soils with 12-20 percent slopes, some with fragipans, having a corn yield potential of 55-70 bushels per acre.
9C.	Well drained and moderately well drained, severely eroded terrace and upland soils with 12-20 percent slopes, some with fragipans, having a corn yield potential of 40-55 bushels per acre.
10.	Well and excessively drained bottom and upland soils, having a pasture yield of 90-120 animal unit days per acre.

Table III-1 - Soil Resource Group Descriptions for Kentucky Major Land Resource Areas

Soil Resource Group	Description
11.	Well and moderately well drained upland and terrace soils, some with fragipan, having a pasture yield of 110-140 animal unit days per acre.
12.	Well and excessively drained upland soils with a pasture yield of 95-115 animal unit days per acre.
13.	Moderately well to excessively drained upland soils, some with fragipans, and having a pasture yield of 70-100 animal unit days per acre.
14.	Somewhat poorly to poorly drained bottom and terrace soils, having a corn yield potential of 100-115 bushels per acre.
15.	Poorly drained bottom land soils having a corn yield potential of 85-100 bushels per acre.
16.	Poorly and very poorly drained (wet overflow and swampy) soils on bottoms, terraces and uplands, with a corn yield potential of 70-90 bushels per acre when drained.

Source: Soil Conservation Service, Lexington, Kentucky.

Table III-2 - Acres in Soil Resource Groups by Major Land Resource Areas

Kentucky

Group	Major Land Resource Areas					State
	120	121	122	125	134	
	acres x 1,000					
1	194	267	326	149	103	1,039
2	102	22	17	46	111	298
3	27	24	50	--	11	112
4	135	573	685	21	45	1,459
5	558	671	800	198	272	2,499
6	148	744	560	92	17	1,561
7	310	511	787	386	98	2,092
8	6	13	21	3	58	101
9	259	45	145	9	121	579
9A	1	97	84	5	*	187
9B	247	257	346	232	*	1,082
9C	6	297	206	163	*	672
10	4	2	6	7	7	26
11	262	130	173	40	99	704
12	87	696	279	107	47	1,216
13	668	1,468	1,568	5,565	91	9,360
14	740	84	289	165	165	1,343
15	107	35	36	58	171	407
16	89	127	135	7	68	426
Totals	3,950	6,063	6,413	7,253	1,484	25,163

* Soil Resource Group 9 was not disaggregated for MLRA 134.

Source: Soil Conservation Service, Lexington, Kentucky.

operations. To reflect the relative differences, field efficiencies for machinery operations in the study areas are adjusted by SRG and subgroup. These adjustments allow adaptation of base, partial enterprise crop budgets to the soil resource groups.

Resource Management Systems [1/]

Representative resource management systems and homogeneous soil resource groups are used in the analyses of economic and soil conservation impacts in the MLRAs. Each resource management system (RMS) consists of the production of a set of crops in a rotation using a specified tillage method and conservation practice. The RMS is applied to each soil resource group (SRG) to derive economic and soil conservation impacts unique to that SRG. Soil conservation impacts are analyzed by using the Universal Soil Loss Equation and assigning the appropriate R, K, L and S factors for each SRG and C and P factors for each RMS. Economic impacts are analyzed by systematically varying RMS and SRG crop yields, production inputs, machinery use, labor requirements, fuel use, conservation practice costs, and management costs.

Crop Rotations

The procedure for establishing resource management systems for Kentucky MLRAs involved selecting rotations which typify agricultural production in the state. Each system selected is (1) common and actual, (2) includes dominant crops, and (3) portrays in a reasonable fashion the agricultural land-use patterns and crop production methods of the region. Seven rotations selected for the resource management system in the economic and soil conservation impact analyses, are shown in Table III-3.

[1/] U. S. Department of Agriculture; Economic Research Service and Soil Conservation Service. "Resource Management Systems for Economic and Soil Conservation Impact Analyses," Kentucky Special Resources Study: Soil Conservation Service, Lexington, Kentucky, June 1985.

Table III-3 - Crop Rotations Selected for Economic and Soil Conservation Impact Analyses by Major Land Resource Area.

Kentucky

Symbol	Description	MLRAs
S-S-S	continuous soybeans	120, 121, 122, 134
C-C-C or C-C	continuous corn	120, 121, 122, 134
C-W/S	corn followed by double cropped wheat and soybeans	120, 121, 122, 134
W/S	continuous double cropping of wheat and soybeans	120, 121, 122, 134
C-C-4ALF	two years of corn followed by four years of alfalfa hay	121, eastern 122
C-C-2H 1/	two years of corn followed by two years of red clover/ fescue hay	121, eastern 122
C-C-2H 1/	two years of corn followed by two years of red clover/ orchard grass hay	121, eastern 122

1/ Footnotes in the Economic and Soil Conservation Impacts report tables identify either fescue or orchard grass hay when the rotation symbols are identical.

Universal Soil Loss Equation

Although data for the Universal Soil Loss Equation factors (R,K,L and S) are included in the reference reports of this study, the information may be obtained from soil survey reports, on site field inspections, and related data on soils in the area of concern. The Cover (C) and Practice (P) factors, which are controlled by the farmer through management, are based on Resource Management System (RMS) characteristics and the SRG. The C factor, a function of vegetal cover and surface residue, is largely determined by the RMS tillage system and the SRG slope. The P factor is identified as a RMS component and is related to the topographic direction of field operations (contouring), cultivation of alternate strips (strip-cropping) or the breaking of long slope lengths (terracing).

Conservation Practices and Practice Costs

Conservation practices considered for erosive soils in SRGs 1-11 are contouring, contour stripcropping and parallel terracing. The practice of farming up and down slopes is used to represent conditions without conservation. For soils with a wetness condition (SRGs 14-16), surface and tile drainage practices are considered.

Installation, operation and maintenance costs for the conservation practices are based on data developed by the Soil Conservation Service, Lexington, Kentucky. A 12 percent interest rate is used to amortize installation costs. Annual operation and maintenance costs are added to amortized installation costs to determine average annual costs.

SECTION 2 - METHODS OF ANALYSES

The methods employed to analyze economic and soil conservation tradeoffs for alternative resource management systems by soil resource group include (1) the Universal Soil Loss Equation for predicting annual soil loss from sheet erosion, (2) a partial budgeting system to estimate the short-run value of production, costs of production and net returns for resource management systems by soil resource group, and (3) a soil depletion model to estimate the long-run economic benefit a farmer could capture by converting to a resource management system which erodes at or below a soil tolerance or T value. Depletion estimates are conducted for representative soils in selected soil resource groups for MLRA 134, the Jackson Purchase Area. A summary of each method follows with detailed descriptions provided in Appendix C, Chapter III Reference Information.

Universal Soil Loss Equation

Annual soil loss per acre for sheet and rill erosion is estimated using the Universal Soil Loss Equation. The equation incorporates five factors which can be measured from available data. A sixth factor, the tolerance value, is a benchmark annual soil loss rate above which soil depletion is expected to occur.

The Universal Soil Loss Equation (USLE) is expressed as A=RKLSCP wherein:

A is the predicted soil loss;
R is the rainfall factor;
K is the soil-erodibility factor;
LS is the slope-length and slope-gradient factor;
C is the cropping-management factor; and
P is the erosion-control practice factor.

The soil loss tolerance (T) values and soil loss equation factors (R,K,LS) are presented by soil resource group for each analyzed Major Land Resource Area (MLRA) in the Kentucky Special Resource Study (KSRS) report entitled, "Soil Resource Groups for Economic and Soil Conservation Impact Analyses." Cover (C) and Practice (P) factors, which are dependent on the resource management system, are found in the same report. Descriptions of the management systems are presented in KSRS report entitled "Resource Management Systems for Economic and Soil Conservation Impact Analyses." The cover (C) factors are specified by rotation and tillage method and practice (P) factors are specified by soil conservation practice for each soil resource group and each MLRA.

Erosion rates are displayed in individual KSRS reports, "Economic and Soil Conservation Impacts: Alternative Resource Management Systems by Soil Resource Group" for MLRAs 120, 121, 122 and 134. The erosion rates which are specified by rotation, tillage method and conservation practice are presented by soil resource group and MLRA.

Partial Budgeting - Short Run

A partial budgeting system is used to analyze short-run profitability of resource management systems by soil resource group and MLRA. Individual crop budgets by tillage method and soil conservation practice are linked together to form rotations. Rotations specified by tillage method and conservation practice are referred to as resource management systems (RMS). RMS analyses are conducted for each soil resource group (SRG) for MLRAs 120,121,122 and 134.

The budgets show the expected net returns by rotation, tillage method, and practices for the grain crops produced in Kentucky. Practices used where appropriate, include (a) farming up and down slopes (no conservation), (b) contouring, (c) contour stripcropping, (d) parallel terraces, (e) tile drainage and (f) surface drainage. Annual costs are amortized at 12 percent interest rate for the usual life of practice. Operation and mantenance costs are added to amortized installation costs to determine average annual practice costs.

Production returns, production costs, and net returns by soil resource group and resource management system are presented in KSRS reports "Economic and Soil Conservation Impacts: Alternative Resource Management Systems by Soil Resource Group" for Kentucky MLRAs 120, 121, 122 and 134. The results of these impact analyses are summarized and evaluated in Chapter III, Sections 3 and 4 of this chapter.

Soil Depletion Estimate - Long Run

In the long-term, excess erosion can cause on-site productivity loss or soil depletion. To calculate the economic effects of soil depletion, the Soil Depletion Estimates (SDE) model was developed. The SDE model is used to calculate the break-even point for the annual investment required for soil conservation practices needed to sustain productivity and achieve an erosion rate of T or less. The annual investment, when considered with net return changes from partial budgeting, can be used to examine the economic rationality of resource management system conversions.

Soil depletion estimates are made for representative soils from selected soil resource groups in MLRA 134, the Jackson Purchase Area. Twelve resource management systems analyzed were corn followed by double cropped wheat and soybeans for three tillage methods (conventional, conservation, no-till) and four land utilization practices (up and down plowing, contouring, contour stripcropping and parallel terraces). The results are summarized in sections 3 and 4 of this Chapter and in detail in the Kentucky Special Resources Study report "Soil Depletion Estimates: Results and Interpretations by Soil Resource Group for Kentucky's Jackson Purchase Area."

SECTION 3 - SOIL CONSERVATION IMPACTS BY MLRA

This section presents the results of the economic and soil conservation impact analyses conducted for Major Land Resource Areas 120, 121, 122, and 134. The results, which are summarized in Tables III-4 to III-7, are presented by soil resource groups to show the tillage method having the highest net return for erosion rates above and below T. More detailed data on the alternatives evaluated are provided in appendix C, Tables 7-10, and in the reference reports prepared as part of this study. 1/

Results are summarized for each MLRA by the following individual or grouped soil resource groups:

Soil Resource Group(s)	General Description
1, 2, 3	Moderately well to well drained, bottom and terrace soils
4, 5, 6, 7	Moderately well to well drained, upland and terrace soils
8, 9	Moderately well to well drained, severely eroded upland and terrace soils
10	well to excessively well drained, bottom and upland soils
11	Moderately well to excessively well drained upland and terrace soils
14, 15, 16	Very poorly to poorly drained bottom, terrace and upland soils

For clarification it should be noted that: (1) The tillage method shown by SRGs in Tables III-4 -III-7 is a label not a prescription. The tillage method only partially identifies a resource management system. For example, in MLRA 120 on soil resource group 4, no-till is the most profitable tillage method with an erosion rate below T. This resource management system (RMS)is fully identified in the Impacts report for MLRA 120 as continuously double-cropped wheat and soybeans under no-till with up and down slope (straight row) plowing as the land utilization practice. (2) The economic and soil conservation impact analyses are static, and therefore, the results are a reflection of current conditions. The analyses are based on specific commodity prices; machinery, labor and fuel costs; interest rates for borrowed capital, and other economic factors that may change over time and the changes may alter relative profitability. (3) Technology is assumed constant in the analyses. Also, net returns are returns to land and risk as a management cost has been added. (4) The reference to fixed costs in this section includes those costs which do not vary with the level of output, such as equipment purchases, structural conservation practices and land charges. Variable costs, which vary with output level, include interest, fuel, labor, seed, herbicides, pesticides, etc.

1/ For more detail information on the alternatives evaluated, see the reference reports "Economic and Soil Conservation Impacts: Alternative Resource Management Systems by Soil Resource Group" for MLRAs 120,121, 122, and 134.

MLRA 120 - Kentucky and Indiana Sandstone and Shale Hills and Valleys

(Western Coal Fields)

The economic and soil conservation impacts are presented in Table III-4, with a brief discussion by SRG provided below.

SRGs 1,2,and 3 - With few exceptions, these highly productive bottom and terrace soils show no erosion problem (erosion rates less than T value) even when conventionally tilled. Consequently, conventionally tilled management systems have the highest net returns, ranging from $113-158 per acre for grain crops, depending on the soil resource group's inherent productivity.

SRGs 4,5,6, and 7 - Erosion rates for the majority of the conventional and conservation management systems used on the 2-12 percent sloping upland and terrace soil resource groups exceed T. For SRGs 4,5, and 6, the no till system reduces erosion below T and is most profitable with returns ranging from $134-166 per acre. For SRG 7, no till with straight rows and with erosion above T provided to most favorable returns, $94 per acre. When contouring is added to the no till system, erosion on SRG 7, is reduced below T but returns are $2 less than the $94 level.

SRG 8 and 9 - For these less inherently productive, more sloping, and severely eroded soil resource groups, impact analyses show negative net returns for erosion levels above and below T. Although no till and conservation management systems with appropriate conservation practices can be used to reduce erosion to or below T, the returns may only be sufficient to cover variable costs and, at best, a portion of the fixed costs.

SRG 10 - Consists primarily of Capability Class IIIs soils with productivity limited due to stoniness and excess drainage. Most of the management systems used on the 0-4 percent sloping soils will keep erosion at or below T. The highest net return of $20 per acre is provided by the conventional tillage system.

SRG 11 - Soils in SRG II are predominately in Capability Class VIe, are on 12-30 percent slopes, and, when used for cultivable crops, are highly erodible. All resource management systems analyzed for corn, wheat, and/or soybeans for this group of soils eroded in excess of T and provided negative net returns. It is generally recommended that the Class VIe lands be converted to grass or trees for control of erosion.

SRGS 14,15, and 16 - This group includes wet (w) natured soils in Land Capability Classes IIw, IIIw, and IVw. In some years and on certain soils in these groups, natural drainage is sufficient for satisfactory crop yields. In other years, inadequate drainage and flooding on some of the soils affects crop and pasture yields. Excess internal, ponded, or overflow water impedes plant growth, physically damages plants, or prevents timely seeding and/or harvesting operations. Increased productivity may be attained by installing surface and/or subsurface drainage systems. Impact analyses for soils in SRG 14, 15 and 16 are conducted to indicate the feasibility of installing drainage systems. The profitability depends on analyzing net returns attained when (1) natural drainage is adequate and productivity levels are high, (2) natural

Table III-4 - Tillage Method with Highest Net Returns For Resource Management System Options With Erosion Above and Below T by Soil Resource Group for MLRA 120

Kentucky

Soil Resource Group	Erosion Rate < T		Erosion Rate > T	
	Tillage Method [1/]	Net Returns ($)	Tillage Method	Net Returns ($)
1	COV.	158*	COV.	103
2	COV.	132*	COV.	131
3	COV.	113*	--	--
4	NT	166*	COV.	143
5	NT	138*	COV.	112
6	NT	134*	COV.	108
7	NT	92	NT	94*
8	NT	-22	COV.	-11*
9G	CON.	-58	COV.	-37*
9H	NT	-98	COV.	-60*
10	COV.	20	COV.	21*
11	--	--	COV.	-10*
14	COV.	119*	COV.	85
15	CON.	73	COV.	77*
16	CON.	-8	COV.	-6*

[1/] Tillage methods are conventional (COV.), Conservation (CON.) and no-till (NT).

* Denotes the highest net return level for the soil resource group.

drainage is inaddequate and productivity levels are significantly lower, and (3) artificial drainage systems are installed and productivity levels are improved.

Net returns expected with installed drainage systems depend upon several factors, especially the type of system used, installation cost, increase in yield, and price of product (crop) produced. In the analyses conducted for SRG 14 and 15, the net returns for all management systems on undrained soils exceed those for the systems on artificially drained soils. This results from the annual installation, operation and maintenance costs of the drainage systems exceeding the annual returns derived from installing the systems. The conventional management systems on undrained soils eroding below T for SRG 14 and above T in SRG 15 are most profitable at $119 and $77 per acre, respectively. Net returns for SRG 16 under all management systems, whether with or without drainage, are negative.

MLRA 121 and Eastern MLRA 122 - Kentucky Bluegrass and (Eastern)

Highland Rim and Pennyroyal

The following provides data on the economic and soil conservation impacts, which are summaried in Table III-5.

SRGs 1, 2 and 3 - Erosion rates on these highly productive bottom and terrace soils are usually less than T even when conventionally tilled. Characterized by a lower cost of production per acre than conservation or conventional systems, no till systems eroding at less than T are most profitable, with estimated returns ranging from $79-132 per acre.

SRGs 4, 5, 6 and 7 -The upland and terrace soils in SRGs 4, 5, 6 and 7 range in slope from 2-12 percent and erosion rates by management systems and tillage method are well mixed above and below T. As in SRGs 1, 2 and 3, no till management systems are characterized by lower production costs relative to conventional and conservation systems. No till systems eroding at less than T are the most profitable, ranging from $30-110 per acre, depending on a SRGs inherent productivity.

SRGs 8 and 9 - Impact analyses for these less inherently productive, more sloping, severely eroded soil resource groups show negative net returns above and below T for the best (most profitable) management systems. Since management systems for MLRA 121 and eastern MLRA 122 include cash grain options without and with hay crops, the analyses indicate that production returns generated from use of these soils may not cover variable costs. Impact analyses for management systems based strictly on hay crops and/or pasture enterprises should be conducted to evaluate opportunities for profitable farming.

SRG 10 - Consists of Capibility Class IIIs and IVs soils with slopes ranging from 2-12 percent. The productivity of these soils is limited by the inherent droughty, shallow, and stony characteristics. Impact analyses for cash grain farming systems with or without hay crops uniformly result in negative net returns. From an economic perspective, it is questionable whether production revenues from the studied management systems would be sufficient to

Table III-5 - Tillage Method With Highest Net Returns for Resource Management System Options With Erosion Above and Below T by Soil Resource Group for MLRA 121 and Eastern MLRA 122

Kentucky

Soil Resource Group	Erosion Rate ≤ T		Erosion Rate > T	
	Tillage Method [1/]	Net Return ($)	Tillage Method	Net Return ($)
1	NT	132*	--	--
2	NT	107*	COV.	52
3	NT	79*	--	--
4	NT	110*	COV.	54
5	NT	72*	CON.	36
6	NT	86*	CON.	81
7	NT	30*	CON.	26
8	NT	-42*	CON.	-50
9G	NT	-61	NT	-60*
9H	NT	-89	NT	-88*
9I	NT	-62	NT	-60*
9J	NT	-109	NT	-88*
10	NT	-24*	COV.	-47
11	--	--	NT	-27*
14	CON.	44*	COV.	37
15	CON.	21*	COV.	15
16	CON.	-53*	COV.	-59

[1/] Tillage methods are Conventional (COV.), Conservation (CON.) and No Till (NT).

* Denotes highest net return level for the soil resource group.

cover variable costs. As in SRGs 8 and 9, management systems based strictly on hay crops and/or pasture enterprises should be conducted to evaluate opportunities for profitable farming.

SRG 11 - The soils in SRG 11 are highly erodible and all management systems evaluated erode in excess of T. Productivity of this SRG is measured in terms of animal unit days (aud) for pasture. It is generally recommended by USDA that Class VIe lands be used for grass or trees to control erosion.

SRG's 14, 15, and 16 - These Capability Class IIw, IIIw, and IVw soils are wet natured but drainage may be adequate on certain soils and/or in certain years to achieve a relatively high level of productivity. When natural drainage is inadequate, lower productivity results from excess water damage on certain soils. The level of productivity may be improved on most of the soils by applying surface and/or tile drainage practices.

Impact analyses for these SRGs are conducted to provide information for determining whether the cost of drainage is economical. Consequently, the tillage system labeled as most profitable in Table III-5, whether erosion is above or below T, always represents a condition where natural drainage is adequate. The decision on whether to or not to install drainage may be determined by analyzing net returns attained when (1) natural drainage is adequate and a higher level of productivity may be achieved, 2) natural drainage is inadequate and productivity levels are lower, and (3) artificial drainage systems are installed to improve the level of productivity.

For SRGs 14 and 15, net returns for management systems evaluated on undrained soils having high or low productivity levels exceeded the returns attained on artificially drained soils. This results because the value of the productivity loss on undrained soils is less than the annual costs of installing, operating, and maintaining drainage systems. As shown in Table III-5, conservation tillage on undrained soils, with net returns of $44 per acre for SRG 14 and $21 per acre for SRG 15, is the most profitable system. Net returns to all management systems, whether with or without drainage, are negative for SRG 16.

Western MLRA 122 - (Western) Highland Rim and Pennyroyal

Table III-6 provides summary data on the economic and soil conservation impacts, with a brief discussion following.

SRGs 1, 2 and 3 - These highly productive bottom and terrace soils normally erode at less than T even when conventionally tilled. Characterized by a lower cost of production per acre than conventional or no till tillage methods, conservation tillage systems eroding at less than T are most profitable, ranging from $75 -146 per acre depending on a soil resource group's inherent productivity.

SRG's 4, 5, 6 and 7 - These groups include upland and terrace soils with slopes ranging from 2-12 percent. Erosion rates for the SRGs vary from below to above T, depending upon the management system and tillage method used. Net

returns, which range from $128 for SRG 4 to $55 for SRG 7, are obtained using the conservation tillage system. Except for the $128 per acre net return obtaind with erosion rates less than T on SRG 4, the highest returns for SRGs 5,6, and 7 are on soils eroding in excess of T.

SRGs 8 and 9 - As compared to the previous group, SRGs 8 and 9 possess less inherently productive, more sloping, and severely eroded soils. Impact analyses show highly negative net returns for soils above and below T for the best (most profitable) cash grain producing management systems. Since production revenues from cash grain farming on these soils are unlikely to be sufficient to cover variable costs, impact analyses for management systems which include hay crop and/or pasture enterprises should be conducted to evaluate opportunities for profitable farming.

SRG 10 - Consists mostly of Capability Class IIs soils that are excessively drained and have a stoniness characteristic. With slopes ranging 0-2 percent, most management systems for SRG 10 erode at less than T. The most profitable system is a conservation tillage system eroding at less that T with net returns of $5 per acre, which is indicative of sufficient production revenues to cover variable costs and most fixed costs. Further impact analyses for management systems including hay crop and/or pasture enterprises are suggested to evaluate opportunities for more profitable farming.

SRG 11 - The soils in SRG 11 are highly erosive and, when used for crop production, all management systems erode in excess of T. Productivity for this group is measured in terms of animal unit days (aud) for pasture. It is generally recommended by USDA that these Class VIe lands be in trees or permanent cover to control erosion.

SRGs 14,15, and 16 - These groups are in Land Capability Classes IIw, IIIw, and IVw and have drainage or excess water problems. However, natural drainage on some soils and in some years is adequate for relatively high levels of production. When natural drainage is inadequate, the excess surface and subsurface water significantly affects crop and pasture yields. Higher productivity on the wet natured soils may be achieved by applying surface and /or tile drainage systems.

The impact analyses conducted for SRGs 14, 15 and 16 provide information for determining if drainage is economical. While the most profitable system will be the one providing the greatest net return, the profitability may be determined by analyzing net returns when (1) natural drainage is adequate and productivity levels are unaffected, (2) natural drainage is inadequate and productivity levels are affected, and (3) installed artificial drainage practices result in higher levels of productivity.

For SRGs 14 and 15, net returns for management systems with artificial drainage are lower than net returns on undrained soils having either high or low productivity levels. This results because economic loss from excess water is less than the annual costs of artificial drainage systems. Conservation tillage management systems on undrained high productivity soils that erode below T are most profitable at $84 and $39 per acre, respectively, for SRGs 14 and 15. Negative net returns were obtained for all management systems for SRG 16.

Table III-6 - Tillage Method With Highest Net Returns for Resource Management System Options With Erosion Above and Below T by Soil Resource Group for Western MLRA 122

Kentucky

Soil Resource Group	Erosion Rate < T		Erosion Rate > T	
	Tillage Method 1/	Net Return ($)	Tillage Method	Net Return ($)
1	CON.	146*	COV.	61
2	CON.	116*	--	--
3	CON.	75*	--	-
4	CON.	128*	COV.	112
5	CON.	86	CON.	87*
6	NT	77	CON.	78*
7	NT	41	CON.	55*
8	CON.	-66	CON.	-45*
9G	CON.	-96	CON.	-75*
9H	CON.	-126	CON./NT	-99*
9I	NT	-119	CON.	-75*
9J	NT	-149	CON./NT	-99*
10	CON.	-5	CON.	-16
11	--	--	CON.	-40*
14	CON.	84	COV.	69
15	CON.	39*	CON.	37
16	CON.	-34*	COV.	-52

1/ Tillage methods are conventional (COV.), Conservation (CON.) and no till (NT).

* Denotes the highest net return level for the soil resource group.

MLRA 134 - Southern Mississippi Valley Silty Upland

(Jackson Purchase Area)

Impact analyses for MLRA 134 are conducted for erosion phase/management level subgroups of soil resource groups (Table III.7). The subgroups selected to summarize results for this MLRA closely match the soil resource groups analyzed in MLRAs 120, 121 and 122. 1/

SRG's 1B, 2B and 3B - With few exceptions, these highly productive bottom and terrace soils show erosion rates less than T even when conventionally tilled. Consequently, the conventional tilled management systems have the highest net returns, ranging from $113-158 per acre, depending on the soil resource group's inherent productivity.

SRGs 4B, 5B, 6B and 7B - Erosion rates on these 2-12 percent sloping upland and terrace soil resource groups exceed T for most conventional and conservation tillage systems evaluated. Except for a few no till systems, erosion rates are below T for all the SRGs. Gross returns for no till systems are proportionally higher than those for conventional or conservation systems, and sufficiently high enough to offset no till's higher cost of production. As a result, no till systems are shown to be most profitable, ranging from $89-$161 per acre, for systems eroding above and below T. For SRGs 4B and 5B, no till systems eroding below T are most profitable. For SRGs 6B and 7B, no till systems eroding above T are most prifitable but only $2 higher than counterpart no till systems eroding below T.

SRGs 8E, 9C, and 9E - These are less inherently productive, more sloping, moderately eroded to severely eroded soil resource groups/subgroups. Impact analyses for the groups uniformly show negative net returns for cash grain resource management systems which erode at less that T. Since production returns from cash grain farming on these soils are unlikely to cover variable costs, impact analyses for management systems with hay crop and/or pasture enterprises are suggested to evaluate opportunities for profitable farming.

SRG 10B - This SRG consists mostly of capability Class IIIs and IVs soils with productivity limited due to stoniness and excess drainage. Erosion rates for conventional tillage management systems on the 0-12 percent sloping soils are about equally above and below T. Most conservation and no till systems used on this SRG erode at less than T. A conventional system (continuous corn with no conservation practice) eroding in excess of T resulted in the highest net return of $21 per acre. A conservation system (continuous corn with contour farming) resulted in the highest net return of $17 per acre for systems eroding below T.

1/ Soil resource subgroups used in MLRA 134 to represent different management levels and degree of erosion include B for slightly eroded soils with high management levels, C for moderately eroded soils with average management, D for moderately eroded soils with high management, and C for severely eroded soils with average management.

Table III-7 - Tillage Method With Highest Net Returns for Resource Management System Options With Erosion Above and Below T by Soil Resource Group for MLRA 134

Kentucky

Soil Resource Group [1] and Subgroup	Erosion Rate ≤ T		Erosion Rate > T	
	Tillage [2] Method	Net Return	Tillage Method	Net Return
		$		$
1B	COV.	158*	COV.	103
2B	COV.	132*	COV.	88
3B	COV.	113*	COV.	66
4B	NT	161*	COV.	146
5B	NT	134*	COV.	112
6B	NT	128	NT	130*
7B	NT	87	NT	89*
8E	NT	-29	COV/CON.	-18*
9C	NT	-29	COV.	4*
9E	NT	-77	COV/CON.	-46*
10B	CON.	17	COV.	21*
11D	--	--	COV.	-10*
14	CON.	116	COV.	119*
15	CON.	73	COV.	77*
16	CON.	-8	COV.	-6*

[1] Letter Suffixes: B = slightly eroded, high management

C = moderately eroded, average management

D = moderately eroded, high management

E = severely eroded, average management

[2] Tillage methods are Conventional (COV.), Conservation (CON.) and No Till (NT).

* Denotes the highest net return level for the soil resource group.

SRG 11D - Soils in SRG 11 are highly erosive and all management systems evaluated erode in excess of T. Productivity was measured in terms of animal unit days (aud) for pasture. It is generally recommended by USDA that these Capibility Class VIe lands be used for trees or permanent cover to control erosion.

SRGs 14,15, and 16 - These are capability Class IIw, IIIw and IVw soils that are poorly to very poorly drained. However, natural drainage on certain soils and/or in certain years may be adequate to achieve moderately high productivity. When natural drainage is inadequate, the excess water significantly lowers productivity. Higher productivity on the wet soils may be achieved by installing surface and/or tile drainage systems.

Impact analyses for these SRGs provide information for determining the profitability of installing drainage systems. The most profitable tillage system in Table III.7, whether for erosion rates above or below T, will always represent a condition where natural drainage is adequate. The profitability depends on analyzing net returns expected when (1) natural drainage is adequate and productivity is unaffected, (2)natural drainage is inadequate and productivity is lower and (3) artificial drainage systems are installed to attain higher levels of productivity.

For most of the soils in SRGs 14 and 15, net returns for management systems without tile drainage are higher than net returns for tillage systems with artificial drainage practices. This results because economic loss from excess water is less than the annual costs of artificial tile drainage system. Assuming the artificial drainage costs and returns are representative, one would not expect artificial tile drainage to be installed.

Net returns for management systems with artificial surface drainage for some soils in SRGs 14 and 15 are higher than net returns without drainage. When this occurs information about rainfall patterns and amounts can be used to determine, on a case by case basis, whether surface drainage is economical. For example, net returns for continuous corn using conservation tillage in SRG 14 were $102 per acre on adequately drained productive soils, $58 per acre for inadequately drained low productivity soils and $72 per acre on artificial drained high productive soils. Based on this analyses, a annual net return of $72 per acre could be expected with drainage, regardless of rainfall. If rainfall is expected to result in a productivity loss without drainage for seven or more years out of 10, the economics of the drainage installation can be analyzed as follows:

1/10 [(# years) (high productivity, natural drainage) + (# years) (low productivity, natural drainage)] = average annual expected per acre net return

1/10 [(0) ($102) + (10)($58)] = $58.00
1/10 [(1) ($102) + (9) ($58)] = $62.40
1/10 [(2) ($102) + (8) ($58)] = $66.80
1/10 [(3) ($102) + (7) ($58)] = $71.20
1/10 [(4) ($102) + (6) ($58)] = $75.60

The net returns of $72 per acre with surface drainage are higher for any of the situations where seven or more years of wetness induced productivity loss is expected.

SRG 16 has severe wetness condition, and requires artificial drainage to achieve high levels of productivity. However, net returns to all management systems evaluated, whether artificially drained or undrained are negative.

Soil Depletion Estimates

Estimates of long-term erosion induced productivity loss for MLRA 134, the Jackson Purchase Area, are conducted by using a soil depletion estimates (SDE) model. The SDE model is used for establishing a relationship between soil loss and productivity change for representative soils in SRGs 4,5,6,7,8 and 10. The SDE output measure MAECP (maximum agricultural expenditure for conservation pratices) is the annual investment required for soil conservation now and which will continue each year thereafter. The MAECP measurement is based on converting from a management system eroding in excess of T to a system eroding at or below T. The MAECP then indicates the annual amount of on-site benefits realized from sustaining productivity. It should be noted that the MAECP will be higher for management systems on soils having high erosion rates and/or soils with a fragile profile. Highlights of the SDE results by SRG, which are summerized in Table III.8, follow.

SRGs 4A and 6A - The representative soil for SRGs 4A and 6A is Memphis, a deep soil with relatively uniform soil horizon properties. Since the unweighted productivity index is identical for each of the three horizons of Memphis, loss of soil from the surface and "sliding" of the 100 centimeter rooting zone down the soil profile does not alter the normalized weighted productivity index. As a result, the most erosive management systems do not result in on-site productivity loss and MAECP values are $0.0.

SRGs 5A and 5C - The representative soils for SRGs 5A and 5C are Grenada and Loring in phases 1 and 2 erosion. Although these soils have relatively uniform soil horizon properties, both are characterized by fragipans which restrict root penetration at a depth less than SDE model's assumed 100 centimeter rooting zone. As excess erosion continues to remove surface soil, the effective rooting zone depth contracts and the normalized weighted productivity index decreases.

MAECP values are greater for phase 2 erosion than phase 1 erosion and greater for Grenada soil than Loring. If Grenada soil in SRG 5C is conventionally tilled up and down slopes (no practices), the SDE show that $10 per acre per year would be invested to reduce erosion from 25 or more tons per acre to or below 3 tons/ac/yr. Since the MAECP value is a break even investment, benefits from erosion reduction would equal costs.

SRG 7A - The representative soils for SRG 7A are Brandon and Loring. Brandon soils are deep well drained with a relatively low unweighted productivity index for the 3rd horizon. As erosion removes soil from the surface, lower productivity soil from horizon 3 substitutes for higher productivity soil from horizon 1 in the rooting zone and the normalized weighted productivity index decreases. MAECP values are greater for phase 2 erosion ($1-8) than for phase 1 erosion ($0-6) and greater for resource management systems with higher erosion rates.

Loring soils have relatively uniform soil horizon properties but have a fragipan which restricts root penetration at a depth less than SDE model's assumed 100 centimeter rooting zone. As excess erosion removes surface soil, the effective rooting zone depth contracts and the normalized weighted productivity index decreases. Again, MAECP values are greater for phase 2 erosion ($1-16) than phase 1 erosion ($1-14) and greater for more erosive resource management systems.

SRG 8C - The representative soil for SRG 8C is Grenada. This moderately eroded soil has relatively uniform soil properties by horizon and a fragipan that restricts root penetration at a depth of approximately 55 centimeters. As excess erosion removes surface soil, the truncated rooting zone contracts to further decrease the normalized weighted productivity index. The productivity (yield) loss results in MAECP values ranging from $1 to $8 as erosion rates increase from 5 to 27 tons/ac/yr.

SRG 10A - The Crevasse soil, representing SRG 10A, is deep and sandy with low unweighted productivity indicies by horizon. As erosion removes the surface soil, the normalized weighted productivity index decreases. MAECP values of approximately $2 and $4 are indicated for the two resource management systems having erosion rates of 6 and 12 tons per acre per year.

Table III-8 - Summary of Soil Depletion Estimates by Soil Resource Group, Erosion Phase, Representative Soil and Management System for the Jackson Purchase Area, MLRA 134

Kentucky

Soil Resource Group and Erosion Phase 1/	Soil Series	Management System		Erosion Rate T/A/Y	MAECP 2/ by Erosion Phase	
		Tillage	Practice		1 = A	2 = C
					---------$---------	
4A	Memphis	Conventional	Up and down	25	0	
	4 percent slope	Conventional	Contouring	12	0	
	T = 5	Conservation	Up and down	8	0	
		Conventional	Stripcropping	6	0	0
5A, C	Grenada	Conventional	Up and down	25	8.73	10.31
	4 percent slop	Conventional	Contouring	12	4.05	4.70
	T = 3	Conservation	Up and down	8	2.70	3.06
		Conventional	Stripcropping	6	2.03	2.25
		Conservation	Contouring	4	1.37	1.44
5A, C	Loring	Conventional	Up and down	25	7.17	9.66
	4 percent slope	Conventional	Contouring	12	3.14	4.50
	T = 3	Conservation	Up and down	8	2.00	2.99
		Conventional	Stripcropping	6	1.47	2.25
		Conservation	Contouring	4	.95	1.52
6A	Memphis	Conventional	Up and down	62	0	
	8 percent slope	Conventional	Contouring	37	0	
	T = 5	Conservation	Up and down	20	0	
		Conventional	Stripcropping	19	0	
		Conservation	Contouring	12	0	
		Conventional	Terracing	7	0	
		Conservation	Stripcropping	6	0	

1/ Soil Resource Group letters indicate erosion phase: A = phase 1, C = phase 2, E = phase 3.

2/ MAECP or maximum agricultural expenditure for conservation practices is the annual amount of benefit a farmer would receive when converting to a management system which erodes at T or less.

Table III-8 - Summary of Soil Depletion Estimates by Soil Resource Group, Erosion Phase, Representative Soil and Management System for the Jackson Purchase Area, MLRA 134 (Continued)

Kentucky

Soil Resource Group and Erosion Phase 1/	Soil Series	Management System		Erosion Rate T/A/Y	MAECP 2/ by Erosion Phase 1 = A	2 = C
		Tillage	Practice		$	
7A	Brandon	Conventional	Up and down	49	5.84	7.91
	7 percent slope	Conventional	Contouring	25	2.58	3.63
	T = 3	Conservation	Up and down	16	1.56	2.22
		Conventional	Stripcropping	12	1.13	1.63
		No Till	Up and down	10	.97	1.40
		Conservation	Contouring	8	.73	1.06
		No Till	Contouring	5	.45	.66
		Conventional	Terracing	5	.43	.63
		Conservation	Stripcropping	4	.34	.50
7A	Loring	Conventional	Up and down	49	13.62	15.90
	7 percent slop	Conventional	Contouring	25	6.37	8.05
	T = 3	Conservation	Up and down	16	3.83	5.04
		Conventional	Stripcropping	12	2.79	3.75
		No till	Up and down	10	2.40	3.28
		Conservation	Contouring	8	1.78	2.49
		No till	Contouring	5	1.14	1.63
		Convention	Terracing	5	1.09	1.59
		Conservation	Stripcropping	4	.84	1.27

1/ Soil Resource Group letters indicate erosion phase: A = phase 1, C = phase 2, E = phase 3.

2/ MAECP or maximum agricultural expenditure for conservation practices is the annual amount of benefit a farmer would receive when converting to a management system which erodes at T or less.

Table III-8 - Summary of Soil Depletion Estimates by Soil Resource Group, Erosion Phase, Representative Soil and Management System for the Jackson Purchase Area, MLRA 134 (Continued)

Kentucky

Soil Resource Group and Erosion Phase 1/	Soil Series	Management System		Erosion Rate	MAECP 2/ by Erosion Phase	
		Tillage	Practice	T/A/Y	1 = A	2 = C
					---------$---------	
8C	Grenada	Conventional	Up and down	27		7.54
	4 percent slope	Conventional	Contouring	13		3.86
	T = 3	Conservation	Up and down	10		2.89
		Conventional	Stripcropping	7		1.96
		Conservation	Contouring	5		1.37
		No Till	Up and down	5		1.37
10A	Crevasse	Conventional	Up and down	12	3.79	
	5 percent slope	Conventional	Contouring	6	1.80	

1/ Soil Resource Group letters indicate erosion phase: A = phase 1, C = phase 2, E = phase 3.

2/ MAECP or maximum agricultural expenditure for conservation practices is the annual amount of benefit a farmer would receive when converting to a management system which erodes at T or less.

SECTION 4 - SUMMARY OF RESULTS

Economic and Soil Conservation Impacts

Evaluation of alternative resource management systems by soil resource group for Major Land Resource Areas are conducted by examining economic (profitability) and soil conservation (erosion) tradeoffs. Results presented for each MLRA by individual or grouped soil resource groups are summarized across all MLRAs in an attempt to reach statewide, general conclusions.

SRGs 1, 2, and 3 - The most profitable management systems for these highly productive bottom and terrace soil resource groups are those that erode at less than T. Since relative profitability among tillage methods differs by MLRA, the most profitable management systems are conventional for MLRA 120 and 134, conservation till for western MLRA 122, and no till for MLRA 121 and eastern MLRA 122.

SRGs 4, 5, 6, and 7 - The upland and terrace soils range in slope from 2 to 12 percent and erosion rates for the management systems are mixed above and below T. Conservation or no till management systems are most profitable. In 9 of 16 evaluations across the four analyzed MLRAs, the most profitable management system is estimated to erode below T. For 6 of the remaining 7 SRGs that have erosion rates above T, the most profitable management systems are only $1-2 more than a counterpart conservation or no till management system eroding less than T. SRG 7 in western MLRA 122 would require a $14 acre net return reduction and a cropping system change to achieve an erosion rate below T.

The analysis for most of SRGs 4, 5, 6, and 7, show that conversions to resource management sytems which erode below T are economically rational and may be promoted through technical and educational assistance. In another 6 evaluations very minimal financial assistance coupled with technical and educational assistance would achieve the T erosion rate objective. For the case where financial incentive may be prohibitively expensive, analyses of enterprises which include hay crops or pasture are suggested as a means to achieving erosion objectives and profitable farming.

SRGs 8 and 9 - For these less inherently productive, more sloping, severely eroded soil resource groups, impact analyses generally show negative net returns for the most profitable cash grain and hay crop management systems. Since net returns may cover only a portion of variable costs and certainly not all fixed costs, analyses are needed to explore the economic and soil conservation impacts of alternative enterprises and resource management systems other than those analyzed for this report. Profitable agricultural use of lands in these SRGs may require strictly hay crop and/or pasture enterprises to achieve erosion control.

SRG 10 - Impact analyses for soils in SRG 10, where stoniness and excess drainage limit productivity, present a mixed picture of profitability for Kentucky's MLRAs. MLRAs 120 and 134 show profitable cash grain management systems and minimal financial incentive may be necessary to promote conversion of systems which erode below T. For MLRAs 121 and 122, the analyzed management systems are unprofitable, suggesting that further analyses be conducted for management systems which include hay crop and pasture enterprises.

SRG 11 - The soils in SRG 11 are uniformly unprofitable and none of the analyzed management systems achieve the T value erosion rate objective. It is recommended that these generally Class VIe lands be used for trees or permanent cover.

SRGs 14, 15, and 16 - These Capability Class IIw, IIIw and IVw soils have drainage on excess water problems. In some years, drainage on certain soils may be adequate to achieve a high level of productivity. When natural drainage is inadequate, lower productivity results from excess water on certain soils. Higher productivity may be achieved by installing surface and/or tile drainage systems.

Impact analyses conducted for soils in these SRGs provide information for determining if drainage is profitable. The profitability depends on analyzing net returns when (1) natural drainage is adequate and productivity levels are high, (2) natural drainage is inadequate and productivity levels are lower and (3) installed artificial drainage practices result in higher levels of productivity.

For SRGs 14 and 15 in MLRAs 120,121, and 122 net returns for management systems without drainage are higher than net returns with artificial tile drainage. Since the economic loss from excess water is less than the annual costs of artificial drainage, it would not be profitable to install the artificial tile drainage system. However, net returns on some of the lower productivity soils in SRGs 14 and 15 are higher with articicial drainage than without. While SRG 16 soils have a severe wetness condition and require artificial drainage to achieve a high level of productivity, net returns to all management systems with drainage are lower than without.

Soil Depletion Estimates

The maximum agricultural expenditure for conservation practice (MACEP) value for a specified soil and resource management system represents the break-even point for investment in conservation practices for achieving T. MAECP is a measure only of on-site benefits. Realization of the MAECP benefit is contingent upon converting from a soil and management system that erodes above T to a system eroding at or below T. To evaluate the economic impacts of a conversion, it is necessary to know the MAECP for the current system and the costs and returns for the current and conversion systems. A partial enterprise budgeting process can be used for calculating crop production costs and returns. Data from the two management systems can be used to identify possible change in net return and the benefits of sustained productivity. The combined on-site economic impact in this study may be determined by merging MAECP values with the results from the impact analyses.

CHAPTER IV

FINDINGS AND CONCLUSIONS

This chapter provides some of the findings and conclusions derived from data used or presented in the main report and in the interim reports. As expressed in Chapter II, the primary emphasis in the main report is on resource problems and concerns associated with excessive erosion, sedimentation, water quality and quantity, and land use and land use changes. The interim reports, summarized in Appendix A, provide supporting or additional data on the resource problems, concerns, and cropland use alternatives.

Erosion

Soil erosion continues to be a major problem and concern throughout Kentucky. In 1982, excessive sheet and rill erosion on the state's 5.9 million acres of cropland amounted to almost 57 million tons for an average of 9.5 tons per acre. Erosion on Kentucky's 5.9 million acres of pasture, amounted to almost 17 million tons for an average rate of 2.9 tons per acre. In addition to sheet and rill erosion on these lands, significant erosion occurs on certain forest, road, stream, and development areas.

Approximately 90 percent of the sheet and rill erosion on cropland occurs on the 4.05 million acres in Land Capability Classes IIe -VIIe. Erosion on the erodible "e" soils averaged 12.4 tons per acre per year as compared to a 7 ton per acre rate on land in the other Land Capability Classes and Subclasses. In addition, 89 percent of the 2.7 million acres of cropland identified as needing erosion control treatment is in Land Capability Classes IIe through VIIe. Most of the acreage of cropland with excessive erosion is in the more intensive grain producing areas in west central and western Kentucky (MLRAs 134, 120, and the western portion of 122).

Sediment

Principal sediment sources in the state are surface mines, roadbanks, streambanks, agricultural lands, construction sites, and development areas. Sediment from these sources cause channel filling, infertile deposits on floodplains, stream pollution, and decreased water reservoir storage capacity.

Sediment delivery from surface mining ranges from less than 5 to 50 tons per acre per year, depending on degree of reclamation -stabilization. Statewide it is estimated that surface mining contributed 6-7 million tons per year to the first drainage receiving area. Sediment delivered from road and railroad areas in the eleven watersheds studied ranged from 1-45 tons per acre per year. Streambank erosion, which is estimated to be 11 million tons annually, contributes a signficiant quantity of sediment directly to stream and water bodies. Sediment delivered from eroding crop and pasture lands is estimated at 13 million tons per year. Sediment delivered from eroding construction areas is estimated to range from 10-80 percent of the total erosion on these areas.

Water Quantity and Quality

The 47 inch average annual rainfall in Kentucky is normally sufficient to replenish reservoir and underground storage supplies for agricultural and other uses. However, droughts and water shortages occur because of seasonal variation and uneven distribution of rainfall. Kentucky's 665,000 acres of surface water are estimated to provide about 78 percent of municipal, industrial, and agricultural supply needs. Groundwater provides the remaining 22 percent of supply needs, principally in rural areas.

Water quality in Kentucky varies by area and season, depending largely upon geological conditions, streamflow characterisitcs, and quantity of waste water and effluent material discharged. The most signficiant and widespread natural pollutants are sediment and dissolved materials. Man's activity also contribute numerable soluable materials which pollute water. However, the quality of water in most of Kentucky's smaller streams and reservoirs is good and suitable for most uses. Water quality is also rated good in many of the state's larger streams and reservoirs.

Water quality problems vary by type and magnitude and are distributed throughout the state. The more noticeable problems result from accumulated deposits of solid waste, excessive sediment, and high levels of dissolved chemicals and waste water. Less visible problems include heavy concentrations of dissolved minerals in groundwater, contaminants discharged to streams, and runoff transported pollutants.

Discharge of industrial waste and runoff from a variety of sources affect both small and large water areas. Discharges of animal waste from confined livestock operations usually affect only small areas.

Land Use and Land Use Changes

Land use in Kentucky is changing, both within and outside of agriculture. In 1967, the state had 22,739,785 acres of crop, pasture, and forestland, 1,600,000 acres of urban, built-up and other land, 1,050,000 acres of federal land, and 469,000 acres of water. By 1982, crop, pasture, and forestland had decreased 767,585 acres for an average annual loss in excess of 51,000 acres in the 15 year period. All nonagricultural land uses increased in the 15 year span, with over 500,000 acres going to urban, built-up, and other land uses.

The change from agricultural to nonagricultural land uses have been accompanied by an increase in the acreage of principal farm crops. From 1967 to 1982, the acreage of crops planted increased from 3.6 million acres to over 6.0 million. This included a 1.29 million acre increase in soybeans, 384,000 more acres of corn, 450,000 acre increase in wheat, 280,000 additional acres of hay, and 68,000 more acres of tobacco. The increase in crop acreage resulted primarily from transfer of idle and rotational hay and pasture land to grain crops. Most of the increase in grain crop acreage has been in the west central and western section of the state.

Shifting of agricultural and forest acreage to nonagricultural uses has occurred statewide and has involved some of the state's most productive prime farmland. Recent estimates indicate that an average 12,000 acres of prime farmland are lost to nonagricultural uses each year. In 1982, the state had over six million acres of prime farmland and almost 5.8 million acres of prime forestland.

Conservation Treatment Needs

The 1982 National Resource Inventory shows Kentucky with almost 13.4 million acres of land needing conservation treatment. This included 52 percent of the state's cropland or almost 3.1 million acres; 3.4 million acres or 58 percent of the total pasture acreage; 6.7 million acres or 66 percent of all forestland; and almost 150 thousand acres in farmsteads, mines, and other rural land. Major treatment needs on crop and other land in farmsteads and related uses is for reduction of soil erosion. On pasture and forestland, the dominant treatment needs are for improvement and establishment of plant cover or timber stands.

Appendix C Tables 2 through 4 show the conservation treatment needs by land use for all major land resource areas. Tables IV-1 through IV-6 provide more detailed data on cropland treatment needs by Land Capability Class and Subclass (II through VII) for each MLRA. As shown in Table IV-1, about 78 percent of the cropland erosion control treatment needs are on Land Capability Class/Subclass IIe and IIIe lands. About 60 percent of the cropland drainage needs are on Class IIw land. Table IV-2 relates the soil resource groups to Land Capability Class and Subclass. 1/

The cropland conservation treatment needs by Land Capability Class/ Subclass are related to soil resource groups for each MLRA in Tables IV-3 through IV-6. The data in the tables show the tillage system by soil resource group and by Land Capability Class that reduces soil loss to tolerable limits. Although not included in the tables, conservation practices compatible with the tillage sytems are often necessary to reduce erosion to T or below on some of the soil resource groups.

Alternatives Evaluated

A wide range of alternative resource management systems by MLRA were evaluated during this study. 1/ The alternatives that were analyzed represented conventional, conservation, or no-till management systems with different crop rotations and with or without conservation practices. Output from the evaluations identified the quantity of erosion and level of monetary returns that could be expected for each resource management system by soil resource group by MLRA.

1/ Refer to page 3 and 4 of Chapter III for description of each soil resource group.

Table IV-7 shows the tillage method providing the greatest net return by soil resource group and Land Capability Class for erosion levels below and above T . As shown in this table and in more detail in the individual reports by MLRA, no-till and conservation tillage systems provide the greatest net returns for erosion at or below T for all erosive soil resource groups, except SRG Number 11. This SRG consists of Class VIe land which should be coverted to permanent cover. For erosion above T , conventional and conservation tillage systems provide the greatest returns. When returns are compared for the two erosion levels, below and above T , the no-till system is most favorable, followed by conservation tillage. Conventional tillage is the least favorable. In addition, the data show that it is not profitable to use SRGs 9 and 11 for crop production.

1/ Separate reports on the alternative resource management systems by soil resource group for all MLRAs, except MLRA 125, were prepared and published. These reports contain crop budgets, input data for the resource management systems, and the output by SRG for all MLRAs, except 125.

Table IV-1 - Cropland Acreage Adequately Treated and Needing Conservation Treatment by Land Capability Class and Subclass and MLRA. Kentucky

MLRA	Land Capability Class-Subclass	Adequately Treated	Needing Treatment	
			Erosion	Drainage
		----------acres x 100----------		
120	IIe	1,014	2,884	14
	s	-	-	25
	w	1,773	337	1,617
	IIIe	441	1,102	-
	s	13	15	-
	w	1,389	133	939
	IVe	377	991	-
	s	13	-	-
	w	25	-	-
	Ve	93	517	-
	s	20	-	-
	VIe	14	36	-
	s	15	29	-
121	IIe	3,096	2,242	13
	s	56	18	-
	w	176	-	54
	IIIe	2,160	1,647	-
	w	119	30	101
	IVe	704	552	-
	w	7	-	21
	Vw	7	-	-
	VIe	715	331	-
	s	74	94	-
	VIIe	200	57	-
	s	12	45	-

Table IV-1 - Cropland Acreage Adequately Treated and Needing Conservation Treatment by Land Capability Class and Subclass and MLRA. Kentucky

MLRA	Land Capability Class-Subclass	Adequately Treated	Needing Treatment	
			Erosion	Drainage
		----------acres x 100----------		
122	IIe	3,229	5,540	24
	s	134	26	-
	w	473	184	125
	IIIe	1,734	2,666	-
	w	273	187	124
	IVe	480	954	-
	s	32	-	-
	w	30	40	21
	VIe	160	387	-
	s	16	27	-
	VIs	-	25	-
125	IIe	447	306	-
	s	29	24	-
	w	482	35	223
	IIIe	311	185	-
	IVe	108	174	-
	s	13	-	-
	VIe	51	114	-
	s	52	21	-
	VIIe	95	81	-
	s	23	11	-

Table IV-1 - Cropland Acreage Adequately Treated and Needing Conservation Treatment by Land Capability Class and Subclass and MLRA. Kentucky

MLRA	Land Capability Class-Subclass	Adequately Treated	Needing Treatment	
			Erosion	Drainage
		----------acres x 100----------		
134	IIe	342	1,543	-
	s	87	24	-
	w	542	295	191
	IIIe	115	890	-
	s	24	-	-
	w	327	531	116
	IVe	75	612	-
	w	28	168	22
	Ve	93	517	-
	s	20	-	-
	VIe	24	317	-
	VIIe	19	128	-

Source: 1982 National Resource Inventory.

Compiled from Kentucky Special Resources Study data and reference reports and 1982 NRI.

Table IV-2 - Soil Resource Groups in Land Capability Class and Subclass by MLRA.

Kentucky

Land Capability Class-Subclass	Major Land Resource Area			
	120	121	122	134
	soil resource group			
IIe	4,5	4,5	4,5	4,5
s	3	2,3	2,3,10	2,3
w	14,15	14,15	14,15	14,15
IIIe	6,7,8	6,7,8	6,7,8	6,7,8
s	10	10	-	10
w	14,15,16	14,15,16	14,15,16	14,15,16
IVe	9	9	9	9
s	-	10	-	10
w	-	16	16	16
VIe	11	11	11	11
s	-	-	11	-
w	-	-	-	-

Source: Compiled from Kentucky Special Resources Study data and reference reports.

Table IV-3 - Cropland Acreage Needing Erosion Control and Conservation Data for Land Capability Class and Subclass IIe, s, w, Soils and by Soil Resource Group and MLRA.
Kentucky

Land Capability Class-Subclass	MLRA	Treatment Needed: Erosion	Treatment Needed: Drainage	Soil Resource Group	General Conclusion
		(acres x 1000)			
IIe	120	288.4	-	4, 5	- No till and conservation till resource management systems will reduce erosion below T and are most profitable. - Above could be achieved by promoting technical and educational assistance and would affect over 1.25 million acres.
	121	224.2	-		
	122	554.0	-		
	125	30.6	-		
	134	154.3	-		
		1,251.5	-		
IIs	120	-	-	2, 3	- In general, erosion should not be a problem since nearly all resource management system options erode below T. However, land users should select the management systems that maximize profits. - Isolated erosion problems on 9,200 acres may be treated on a case by case basis, using technical and educational assistance.
	121	1.8	-		
	122	2.6	-		
	125	2.4	-		
	134	2.4	-		
		9.2	-		
IIw	120	33.7	161.7	14, 15	- In general, surface or subsurface drainage practices increase productivity, but should be evaluated on a case by case basis. - Conservation till is sufficient to reduce erosion most w soils.
	121	-	5.4		
	122	18.4	12.5		
	125	3.5	22.3		
	134	29.5	19.1		
		85.1	221.0		

Source: Compiled from Kentucky Special Resource Study data and reference reports and the 1982 NRI.

Table IV-4 - Cropland Acreage Needing Erosion Control and Conservation Data for Land Capability Class and Subclass IIIe, s, w, Soils and by Soil Resource Group and MLRA.
Kentucky

Land Capability Class-Subclass	MLRA	Treatment Needed Erosion	Drainage	Soil Resource Group	General Conclusion
		(acres x 1000)			
IIIe	120	110.2	-	6, 7	-RMS options with no till reduce erosion below T and generally are most profitable or nearly most profitable. - Technical and educationalassistance is appropriate to promote conservation in most situations. Limited financial incentive may be necessary for some.
	121	164.7	-		
	122	266.6	-		
	125	18.5	-		
	134	89.0	-		
		630.5	-		
				8	- Crop production on severely eroded IIIe soils is not profitable and conversion to permanent cover may be necessary.
IIIs	120	1.5	-	10	- Very little acreage needing treatment. - Unprofitable for production of many crops.
	121	-	-		
	122	-	-		
	125	-	-		
	134	-	-		
		1.5	-		
IIIw	120	13.3	93.9	14, 15	- Drainage problems should be evaluated on a case by case basis. - Conservation till is sufficient to reduce erosion on most w soils.
	121	3.0	10.1		
	122	18.7	12.4		
	125	2.0	-		
	134	53.1	11.5		
		90.1	127.9		

Source: Compiled from Kentucky Special Resource Study data and reference reports and the 1982 NRI.

Table IV-5 - Cropland Acreage Needing Erosion Control and Conservation Data for Land Capability Class and Subclass IVe and w Soils and by Soil Resource Group and MLRA.
Kentucky

Land Capability Class-Subclass	MLRA	Treatment Needed		Soil Resource Group	General Conclusion
		Erosion	Drainage		
		(acres x 1000)			
IVe	120	99.1	-	9	- This SRG should be used for hay or pasture. If used for crops, the rotation and conservation systems should be carefully planned.
	121	55.2	-		
	122	95.4	-		
	125	17.4	-		
	134	61.2	-		
		328.3	-		
IVw	120	-	-	10	- Drainage problems should be evaluated on a case by case basis. - Conservation tillage is sufficient to reduce erosion on most "w" soils.
	121	-	2.1		
	122	4.0	2.1		
	125	-	-		
	134	16.8	2.2		
		20.8	6.4		

Source: Compiled from Kentucky Special Resource Study data and reference reports and the 1982 NRI.

Table IV-6 - Cropland Acreage Needing Erosion Control and Conservation Data for Land Capability Class and Subclass VIe, s and VIIe, s and by Soil Resource Group and MLRA.
Kentucky

Land Capability Class-Subclass	MLRA	Treatment Needed: Erosion	Treatment Needed: Drainage	Soil Resource Group	General Conclusion
		(acres x 1000)			
VIe	120	51.7	-	11	- Soils in this soil resource group erode excessively and are not profitable for crop production. - These lands are more suitable for permanent cover.
	121	33.1	-		
	122	38.7	-		
	125	11.4	-		
	134	31.7	-		
		166.6	-		
VIs	120	-	-	10	- Above comments also are applicable to this soil resource group.
	121	9.4	-		
	122	2.7	-		
	125	2.1	-		
	134	-	-		
		14.2	-		
VII e, s	120	6.5	-	12, 13	- Above comments also are applicable to these soil resource groups.
	121	10.2	-		
	122	-	-		
	125	9.2	-		
	134	12.8	-		
		38.7			

Source: Compiled from Kentucky Special Resource Study data and reference reports and the 1982 NRI.

Table IV - 7 - Summary of Estimated Net Return by Tillage Method with Erosion Levels Above and Below T for Soil Resource Groups by MLRA.
Kentucky

Soil Resource Group	Dominant Land Capability Class	T Value[1]/	Major Land Resource Area							
			120		121[2]/		122[3]/		134	
			Till	N.R. ($)	Till	N.R. ($)	Till	N.R. ($)	Till	N.R. ($)
4	IIe	≤T	NT	166*	NT	110*	CON.	128*	NT	161*
		>T	COV.	143	COV.	54	COV.	112	COV.	146
5	IIe	≤T	NT	138*	NT	72*	CON.	86	NT	134*
		>T	COV.	112	CON.	36	CON.	87*	COV.	112
6	IIIe	≤T	NT	134*	NT	86*	NT	77	NT	128
		>T	COV.	108	CON.	81	CON.	78*	COV.	130*
7	IIIe	≤T	NT	92	NT	30*	NT	41	NT	87
		>T	NT	94*	CON.	26	CON.	55*	NT	89*
8	IIIe	≤T	NT	92	NT	30*	NT	41	NT	87
		>T	NT	94*	CON.	26	CON.	55*	NT	89*
9	IVe	≤T	CON.	-58	NT	-61	CON.	-96	NT	-29
		>T	COV.	-37*	NT	-60*	CON.	-75*	COV.	4*
10	IIIs	≤T	COV.	20	NT	-24*	CON.	- 5*	COV.	17
		>T	COV.	21	COV.	-47	CON.	-16	COV.	21*
11	VIe	≤T	-	-	-	-	-	-	-	-
		>T	COV.	-10*	NT	-27*	CON.	-40*	COV.	-10*
14	IIw	≤T	COV.	119*	CON.	44*	CON.	84*	CON.	116
		>T	COV.	85	COV.	37	COV.	69	COV.	119*

Table IV- 7 - Summary of Estimated Net Return by Tillage Method with Erosion Levels Above and Below T for Soil Resource Groups by MLRA.
Kentucky

Soil Resource Group	Dominant Land Capability Class	T Value[1]/	Major Land Resource Area							
			120		121[2]/		122[3]/		134	
			Till	N.R. ($)	Till	N.R. ($)	Till	N.R. ($)	Till	N.R. ($)
15	IIIw	≤T	CON.	73	CON.	21*	CON.	39*	CON.	73
		>T	COV.	77*	COV.	15	CON.	37	COV.	77*
16	IVw	≤T	CON.	- 8	CON.	-53*	CON.	-34*	CON.	- 8
		>T	COV.	- 6*	COV.	-59	COV.	-52	COV.	- 6*

1/ T Value: at or below (≤T) and above (>T). See Appendix Reference information for description of T value.

2/ Data for this MLRA also are applicable for the eastern portion of MLRA 122.

3/ Data for this MLRA applies to the western portion of MLRA 122.

NOTE: The abbreviations used in this table include Till, which refers to the tillage method or system; N.R. refers to net returns; NT refers to No-Till; CON. refers to Conservation Tillage; and COV. refers to Conventional Tillage.

* Denotes highest net return for all analyzed resource management systems in a soil resource group.

Source: Compiled for Kentucky Special Resource Study data and reference reports and the 1982 NRI.

CONCLUSIONS

Several general conclusions may be obtained from the data and results of this study and the reference reports. Although the conclusions or observations may not necessarily be new or be fully supported by study data, they reflect certain conditions and highlight the origin and status of some resource problems and concerns.

General

1. Kentucky's landscape, reflected largely by the diverse topographical features, land, minerals, water, and related resources in the major land resource areas, has influenced the different cultural patterns and economic conditions in the state.

2. Agriculture, with total annual cash receipts exceeding two billion dollars, remains one of Kentucky's most important industries.

3. Tobacco, soybeans, and corn are the major crops in the state and beef and dairy cattle the principal livestock.

4. Minerals are valuable natural resources in Kentucky, with the annual value of coal produced in recent years approaching four billion dollars.

5. Water quantity is generally sufficient for most needs but periodic supply shortages and quality problems occur.

6. Forests, the largest occupier of land, are distributed throughout Kentucky, with the greatest concentration of acreage being in the mountainous area of eastern Kentucky.

7. Kentucky has a variety of fish and wildlife species, with the largest number being in the western section of the state which has more suitable land and water habitat.

Land Use

Conversion of farmland, especially prime farmland, to nonagricultural uses continues to reduce the agricultural land base and affect the state's crop production capacity. Even though the loss of prime farmland has been offset at the regional and state level by the increase in agricultural productivity, the long run effects of conversion could deter development of large scale commercial grain producing enterprises, accelerate shifts of production onto marginal lands, and stimulate more intensive land use, all of which could increase erosion problems.

Cropland Management

As noted in this report, 68 percent of the state's cropland acreage is on Land Capability Class IIe through VIIe soils on which 90 percent of the total cropland erosion occurs. In using these erosive lands, data in this study indicate that:

1. No till and conservation tillage systems along with compatible conservation practices are needed to reduce cropland erosion rates to or below T and provide the most favorable net return on Class IIe and IIIe lands (SRGs 4-8).

2. Conventional tillage systems without adequate conservation practices provide favorable (not necessarily the most favorable) crop returns on Class IIe and IIIe lands but erosion rates are excessive.

3. Crop production on Class IVe -VIIe lands is not profitable as gross returns seldom exceed total production costs and, in many cases, returns do not cover variable costs.

4. Net returns per acre can vary widely from farm to farm because of the variables involved such as soils,management efficiency, size of operation, input costs, product price, and related factors involved in crop production.

Implementation

Much has been accomplished by the Soil Conservation Service, other USDA agencies, and local groups in assisting landowners and operators to reduce erosion and related resource problems. While the cooperative efforts of federal, state, and local agencies and groups will, through on-going programs continue to reduce the erosion problems, an acceleration in technical, educational, and financial assistance appears to be needed most to accelerate accomplishments.

APPENDIX A

Summary of Kentucky Special Resource Study Reference Reports

Appendix A provides a brief summary of the reports prepared and distributed as part of the statewide study. It also summarizes the two basin studies, the Green River Basin and the Kentucky River Basin, previously conducted.[1]/ The reports summarized are:

1. Pesticide Use in Kentucky
2. Livestock Confinement and Water Management Systems
3. Construction Site Erosion in Urban and Built-up Areas
4. Land Cover Data for Jackson Purchase Physiographic Area
5. Kentucky's Agricultural Economy by Major Land Resource Area
6. Acreage, Production, and Yield Data for Selected Crops (1969-1981)
7. Soil Resource Groups for Economic and Soil Conservation Impact Analyses
8. Resource Management Systems for Economic and Soil Conservation Impact Analyses
9. Economic and Soil Conservation Impacts: Alternative Resource Management Systems by Soil Resource Group (MLRAs 120,121,122 and 134)
10. Soil Depletion Estimates
11. Soil Depletion Estimates: Results and Interpretations by Soil Resource Group for Kentucky's Jackson Purchase Area.
12. Estimated Gully Erosion on Kentucky Forest Lands
13. Source Distribution of Sediment by First Approximation of Suspended Sediment (FASS) Procedure
14. Kentucky Prime Timberland Study
15. Water Requirements for Forest Industry in Kentucky
16. Roadside and Railroadside Erosion
17. Trend Analyses for Selected Crops in Kentucky by MLRA (1969-1981)

Pesticide Use In Kentucky

This report summarizes the results of a literature review on pesticide use in Kentucky. It is directed primarily toward pesticides used in agriculture and the effects of their use on water quality.

The term pesticide is used to refer to insecticides, herbicides, fungicides, nematicides, fumigants, and defoliants. It also applies to compounds utilized as repellents, attractants, and sterilants. Herbicides, insecticides and fungicides are the ones most widely used in agriculture.

1/ Copies of the reports may be obtained from the Soil Conservation Service, 333 Waller Ave, Lexington, KY 40504, phone: (606-) 233-2759.

Pesticides belong to various and diverse chemical groups. When applied, the pesticides show different persistence, mobilities, and toxicities. Presently, very little is known of the dynamics of dillution and sediment exchange, uptake, transfer, and metabolism by aquatic life of most pesticides. Consequently, the impact of a given pesticide input on the quality of water in streams and lakes cannot be satisfactorily predicted.

Agriculture is the major user of pesticides in Kentucky, accounting for about 95 percent of the total used in the state. Of the pesticides used, herbicides account for 81 percent. Insecticides, acarticides, and nematicides account for about 14 percent of the pesticides used in agriculture. The intensive farming section of western Kentucky account for the largest volume used. In 1979, over 22 million pounds of pesticide active ingredients were used by the agriculture industry in Kentucky.

The use of perticides have contributed greatly to increasing food and fiber output. However, these same pesticides that have benefited man are recognized as a source of potential adverse environmental impact. Pesticides generating the most concern are those that are persistent for long periods and accumulate in the environment, highly toxic to human, fish and wildlife, and used in large volumes over broad areas.

Herbicides, the most widely used pesticide in agriculture are relatively non-persistent. Although extensively used, it is generally agreed that no significant amount of the herbicides is entering or accumulating in water supplies. In addition, there is little evidence that non-persistent pesticides have any permanent impact on aquatic life. Some investigators state that the major controversy over pesticide use may have resulted from harmful effects caused by the extremely persistent organochlorine insecticides, most of which have been banned or restricted.

2. Livestock Confinement and Waste Management Systems

Pollution problems from confined livestock operations are becoming more acute each year. Some operations are handling animal waste in such a manner that the pollution factor is not a problem. However, other operations need animal waste management systems to control pollution from hog, beef, or dairy operations.

Data for this report were collected to indicate the number of confined livestock operations and to provide an estimate of the number and type of animals involved. The data also provide an insight on the number of installed systems, the number of operations having waste management problems, and the number needing treatment facilities. The data were assembled by Major Land Resource Areas (MLRAs).

In MLRA 120, there were approximately 750 confined livestock operations, involving over 85,000 animal units of livestock. Swine accounted for about 75 percent of the total, beef cattle 15 percent and dairy cattle 10 percent. The heaviest confinement of swine occurs in Caldwell, Breckenridge, Edmonson, Daviess, McLean, Muhlenberg, Ohio, Union, and Butler Counties. A total of 340 livestock waste management systems have been installed. Approximately 400 operations have waste management problems and need facilities to handle the animal waste.

Major Land Resource Area 121 includes 38 counties in which there are over 1600 confined livestock operations with over 92,000 animal units. Dairy cattle account for two-thirds of the animals under confinement, hogs constitute 23 percent, and beef 10 percent. A total of 167 waste management systems have been installed in MLRA 121 and around 900 more are needed to reduce the livestock waste management problems.

Twenty six counties make up MLRA 122. This area has almost 1600 confined livestock operations in which approximately 120,000 head of livestock are confined. Dairy cattle account for 55 percent, swine 32 percent, and beef cattle the remaining 13 percent. Approximately 375 livestock waste management systems have been installed in the area with need for about 1000 more to adequately cope with the identified livestock waste management problems.

MLRA 125 includes 33 eastern Kentucky counties. This MLRA has approximately 300 confined livestock operations with over 24,000 animal units. Of the total, poultry amounts to 39 percent, beef cattle 31 percent, dairy cattle 22 percent, and swine 8 percent. This area has more poultry than any other MLRA. Approximately 150 operating units have livestock waste management problems but only three treatment systems have been installed.

MLRA 134 consists of eight counties in the Jackson Purchase Area of Kentucky. This MLRA has 185 confined livestock operations involving approximately 21,000 animal units. These operations are composed of swine, 67 percent, dairy cattle 24 percent, and beef cattle 9 percent. Over 80 livestock waste management systems have been installed and another 125 operating units have livestock waste management problems.

In summary, Kentucky has over 4400 confined livestock operations. Of these, two percent were using livestock waste management systems, 58 percent were not, and 20 percent reported that they did not have waste management problems. The number of livestock confined in Kentucky averaged 77 units per confined operation.

3. Construction Site Erosion in Urban and Built-up Areas

This report was conducted to indicate the amount of erosion occurring on construction sites in urban and built-up areas in the state. Erosion data were collected at the county level for four of the five major land resource areas in the state. Data collected were for active and inactive construction sites but excluded surface mine and related areas.

The western coalfields, MLRA 120, contain approximately 13 percent of the state's urban and construction site acreage. According to the data collected, this area has the smallest amount of construction site erosion in the state. Daviess, Muhlenberg, and Caldwell Counties incurred most of the erosion reported in this area.

In the 38-county Bluegrass Area, MRLA 121, erosion on construction areas is the highest in the state. This area contains around 42 percent of the state's urban and built-up construction area and had over 1300 acres on which excessive erosion occurs. Kenton, Boone, Fayette, Jefferson, and Campbell Counties have the largest quantity of erosion from construction sites.

The 26 county Pennyroyal Area, MRLA 122, contains about 24 percent of the urban and built-up area in the state. Data collected showed that excessive erosion occurs annually on some 200 acres of construction sites. Barren, Hardin, Lyon, and Christian Counties have the largest quantity of construction site erosion in the MLRA.

MRLA 125, with 33 counties in eastern Kentucky includes around 21 percent of the state's urban and built-up areas. This area has the second highest rate of erosion on construction sites. It was reported that over 300 acres of construction area erode excessively. Carter, Rowan, Martin, and Greenup Counties had the largest volume of erosion from the construction sites.

In summary, the data show that more than 1840 acres of construction sites in urban and built-up areas are eroding excessively. These excessively eroding areas are estimated to lose around 238,000 tons annually for an average of almost 130 tons per acre per year.

4. Land Cover in Jackson Purchase Physiographic Area

This report prepared by Mid-America Remote Sensing Center, Murray State University, provides land cover and related data for the eight-county Purchase Area of western Kentucky. The counties include Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, and McCracken.

Basic land cover and trends in land cover were the major products obtained. Land cover is classified by the type of homogeneous group of cover that can be found. Numerous field locations were selected and ground verified to test the overall reliability of the Landsat land cover mapping and verify potential erosion estimates. Some 300 Primary Sampling Units (PSU's) with an average of 42 primary sampling units per county were utilized.

Ground truthing was conducted to verify the satellite imagery. It was based on two primary resources: (1) On-site observation and contact with farmers, county agents, etc., and (2) interpretation of aircraft photography. As a result of the ground truthing activities, the land cover classes were determined to be forest, forest-grass mix, grassland, cropland (row), cropland (double crop or no-till), water, barren land, urban, and inundated areas.

Each geographic coordinate pair was then programmed into the computer and a search made to locate the specific site and identify the corresponding Landsat Land Cover Class. Aerial photograhs, field checks, and personal communications with professional soil scientists/agronomists were then utilized to explain apparent misses.

Five potential erosion categories selected were acceptable, slight, moderate, severe, and extreme. To test the relative accuracy of the potential erosion estimates, 28 sites were located by computer to verify sites from among all five potential erosion classes. The findings were tabularized by the county computations of acreage and percentage in land cover, soil management groups, land cover within soil management groups, and potential erosion levels within soil management groups.

Based on the verification by PSU control data, LANDSAT mapped land cover in the Jackson Purchase with a commulative accuracy of 90 percent. Reliability by county ranged from a low of 80 percent for Graves County to a high of 96 percent for Hickman County. Analysis for verification of the 336 PSU sample locations strongly suggests site recording error on thirty sites, resulting in a reliability of approximately 90 percent. The findings also suggest that for this area, LANDSAT land cover mapping reliability is highly comparable with PSU data when expanded to a per county basis, while mapping 95 percent more surface area.

The Forest Service field test resulted in verification of forty-nine of the fifty forested sample sites for a cumulative reliability of 98 percent. Of the twenty-eight sites selected for verification of the erosion estimates, only one site was confined as a miss. The cumulative erosion estimate accuracy is computed to be 90 percent with field verification confirming reasonable estimate on 27 or 28 sample sites. The findings of this study suggest that for the Jackson Purchase Area of west Kentucky, LANDSAT can provide county specific tabular and map data with accuracies in excess of 90 percent. The forest mapping field verification suggests accuracies greater than 95 percent. Field testing of LANDSAT potential erosion estimates confirms accuracies of greater than 95 percent for the 1981 sample data. Therefore, the findings from this study substantiate the premise that for the area and time frame analyzed, computer assisted LANDSAT data processing provides a county basis for obtaining county based land cover and use data.

5. Kentucky's Agricultural Economy by Major Land Resource Area

This report provides population, employment and income data for Kentucky as well as data on the agricultural industry. The demographic data are presented first, followed by data pertaining to agriculture.

Kentucky's population increased from 2.94 million in 1950 to 3.66 million in 1980, a 24 percent increase. Population increased by 274,000 from 1950 to 1970 and by 442,000 from 1970 to 1980. The 1970-1980 population increase resulted primarily from changing migration patterns.

Net migration, defined as the excess of population growth over natural increase, was negative for the 1950-1970 decades. This resulted in a total population increase of only three and six-percent, respectively, for the two decades. The 1970-80 decade had an in-migration of 205,000 persons, almost one-half of the total increase of 443,000 for ten-year period.

The composition of the population changed from around 63 percent rural in 1950 to less than 50 percent in 1980. In the transition from rural to urban, the farm population decreased from 974,000 in 1950 to 246,000 in 1980. Paralling the increase in population has been an increase in the civilian labor force and total workers employed. Per capita income also showed an increase in the above time frame.

From 1964 through 1978, the number of Kentucky farms decreased by 30,000 from 124,000 to 94,000. A similar decrease occurred in number of farm operators. Individual or family-owned farms constitute around 85 percent of the types of farms. The number of farms with sales over $2,500 increased from 58,000 in 1969 to 79,000 in 1978.

Land in farms decreased from around 16 million acres in 1964 to 14.6 in 1978. Total cropland increased slightly but pasture and woodland acreage decreased. The acreage and quantity produced increased for all major grain crops. The acreage and production of hay remained fairly constant for the time frame. Tobacco acreage increased but the quantity produced decreased slightly.

Crop production inputs, materials, labor, and supplies increased substantially from 1969 through 1978. Likewise, land prices increased sharply. In 1978, product prices, with the exception of tobacco, were near the 1969 level.

6. Acreage, Production and Yield Data for Selected Crops by County and MLRA (1969-1981)

This report provides crop acreage, production, and yield data for the years 1969-1981 by county and by Major Land Resource Area for Kentucky. The data is for wheat, corn for grain, barley, sorghum, dark fire-cured tobacco, dark air-cured tobacco types, all tobacco, soybeans, alfalfa hay, other hay, and all hay.

The acreage, production and yield data for each selected crop are presented by county for each Major Land Resource Area (MLRA) in Kentucky for the years 1969-1981. The county data is also aggregated by MLRA and then summarized for the state.

7. Soil Resource Groups for Economic and Soil Conservation Impact Analyses

This report outlines the establishment of the SRGs, the development of parameters for analyses (Universal Soil Loss Equation Factors, crop yields, management-erosion phase subgroups), and the procedure for linking resource management system partial budgets to the SRGs. Analyses of economic and soil conservation impacts of alternative resource management systems for the Kentucky Special Resources Study were conducted for 16 primary soil resource groups (SRG) in four of five Major Land Resource areas in Kentucky.

This report, the KSRS report "Resource Management Systems for Economic and Soil Conservation Impact Analyses" and the KSRS report, "Economic and Soil Conservation Impacts: Alternative Resource Management Systems by Soil Resource Group" for MLRA 120, 121, 122, or 134 are a unit for conservation planning. The unit enables the user to evaluate economic and erosion tradeoffs for a variety of crop rotations specified by tillage method and conservation practice for each SRG in a MLRA.

8. Resource Management Systems for Economic and Soil Conservation Impact Analyses

The report outlines and describes MLRA regions of application, rotations, component crop budgets, net return calculations and Universal Soil Loss Equation factors for the Resource Management Systems selected for analyses. Analyses of economic and soil conservation impacts of alternative resource management systems (RMS) for the Kentucky Special Resources Study were conducted for 16 primary soil resource groups (SRG) in four of five Major Land Resource areas in Kentucky.

This report, the KSRS report "Soil Resource Groups for Economic and Soil Conservation Impact Analyses", and the KSRS report "Economic and Soil Conservation Impacts: Alternative Resource Management Systems by Soil Resource Group" for MLRA 120, 121, 122, or 134 are a unit for conservation planning. The unit enables the user to evaluate economic and erosion tradeoffs for a variety of crop rotations specified by tillage method and conservation practice for each SRG in a MLRA.

9. Economic and Soil Conservation Impacts: Alternative Resource Management Systems by Soil Resource Group

Separate reports for Major Land Resource Area (MLRA) 120, 121 and eastern 122, western 122, and 134 were prepared under this title. Each report in essence is a handbook for the conservationist making detailed erosion and economic comparisons of alternative resource management systems by soil resource group. Handbooks consist of either two or three sections. Section A presents individual crop budget information where typical inputs and returns for three yield levels are displayed. Section B displays the effects of different crop rotations, tillage options, and soil conservation practices on annual soil loss and net returns by soil resource group. For MLRAs 120 and 134, where more detailed impact analyses were conducted, Section C provides fertilizer, chemical, and equipment complement descriptions for resource management systems.

One of these reports for an appropriate MLRA, the KSRS report "Soil Resource Groups for Economic and Soil Conservation Impact Analyses", and the KSRS report "Resource Management Systems for Economic and Soil Conservation Impact Analyses" are a unit for conservation planning. The unit enables the user to evaluate economic and erosion tradeoffs for a variety of crop rotations specified by tillage method and conservation practice for each soil resource group in a MLRA.

10. Soil Depletion Estimates

The Soil Depletion Estimates (SDE) model was developed in response to expressed concern for a method to calculate long-term, on-site economic and productivity effects of soil depletion. The SDE is designed to complement other Economic Research Service cooperative efforts in an intense economic study of cash grain farming in Kentucky's Jackson Purchase Area. This report is directed to documenting the SDE model, the input file format and the output.

Results are discussed and intepreted by way of an example for a moderately eroded Loring soil series with a fragipan on four percent slopes. Economic and erosion input information are drawn directly from the report "Economic and Soil Conservation Impacts: Alternative Resource Management Systems by Soil Resource Group" for MLRA 134, the Jackson Purchase Area. Soil profile parameters by horizon were drawn from the Soil Conservation Service's Soils 5 -Soil Intepretations Record.

Full application of the SDE model for selected soils in the Jackson Purchase Area is presented in the KSRS report "Soil Depletion Estimates: Results and Interpretations by Soil Resource Group for Kentucky's Jackson Purchase Area".

11. Soil Depletion Estimates: Results and Interpretations by Soil Resource Group for Kentucky's Jackson Purchase Area

This report presents and interprets the Soil Depletion Estimates Model results for representative soils from selected soil resource groups of the Jackson Purchase Area (MLRA 134). 1/ It provides estimates of long-term productivity change attributable to erosion for each of the selected soils. The report complements the analyses conducted on the short-term economic and soil conservation impacts of alternative resource management systems by soil resource group. 2/

1/ Refer to the KSRS report. "Soil Depletion Estimates" for the model description.

2/ For additional information, refer to the following KSRS reports:
   a. "Soil Resource Groups for Economic and Soil Conservation Impact Analyses".
   b. "Resource Management Systems for Economic and Soil Conservation Impact Analyses".
   c. "Economic and Soil Conservation Impacts: Alternative Resource Management Systms by Soil Resource Group" for MLRA 134.

The output from the SDE model indicates the annual investment needed for conservation measures to reduce erosion rates to avoid potential productivity loss. While depending on the soil and erosion rate with specified resource management systems, the on-site benefits attainable by converting to management systems that reduce erosion to or below T range from $0-16 per acre.

12. Estimated Gully Erosion On Kentucky Forest Lands

It was concluded from an estimate of gully erosion on Kentucky's forest lands that most of the gully erosion on forest lands is located in the Jackson Purchase Area and the Western Coal Field section of the state. The gullies are most prominent in the eight county Jackson Purchase Area where an estimated 2,000 acres of gullies are present. Gullies on forest land can be grouped into the following three general categories:

1. Critical areas mapped in SCS soil surveys. In many instances, the area has been abandoned from agricultural use. Through natural succession, a variety of woody vegetation eventually becomes established and the area can be classified as forest.

2. Narrow 1-3' channels or intermittent streams which meander through floodplains. These small gullies are usually shallow in depth and involve only topsoil material.

3. Small canyons with steep walls. These may exceed 15 feet in depth. The area involved may vary considerably, but is estimated to average one acre in size.

13. Source Distribution of Sediment

This report resulted from a request from the KSRS sponsor and included considerable cooperative efforts by KNREPC personnel and USDA personnel. The objective was to apply the First Approximation of Suspended Sediment (FASS) procedure to distribute estimated quantities of erosion and sediment to its source or land use condition. This was accomplished on thirteen watersheds ranging from just over 900 to almost 20,000 acres in size. The watersheds selected were intentionally distributed throughout Kentucky to include several in each major land resource area.

Implementing the FASS procedure involved : (1) selecting watersheds or areas with reliable sediment monitoring data, (2) obtaining land use within the area, (3) obtaining erosion rates for each land use, and (4) estimating the percentage of erosion (for each land use) that become sediment. Final results are expressed in tabular form.

A report on the entire project was prepared. It features a narrative, results tables, maps of each watersheds, and a FASS procedural documentation. The individual results tables for each of the thirteen watersheds are the prime output from the report and the project. A detailed explanation of how all entries on the FASS results tables were derived is included in the narrative.

Copies of the report can be obtained from the SCS State Office in Lexington, Kentucky or the State Headquarters of the Kentucky Division of Forestry in Frankfort, Kentucky.

14. Kentucky Prime Timberland Study

Tabulation and mapping of Kentucky's prime forest land was carried out primarily by study sponsors (KNREPC) and involved the Division of Conservation (KDC), Division of Permits and the Division of Forestry (KDF). The project was designed to determine the extent of prime timberland; locate prime timberland area within Kentucky; develop and generate computerized maps depicting prime timberland; and develop tabular listings to accompany the map products. 1/

Indicator tree species of site index values for each soil series were determined. The latest published SCS soil surveys, reconnaissance surveys and the general geology map of Kentucky were used to map soils. Also, field soil scientists checked and updated soils data. Forest land cover was provided by landsat imagery.

Statewide mapping of Prime Timberland (PTL) by soils series on large scale maps was feasible. To achieve manageable results, soil series were aggregated into compatible associations. In mapping, the associations were categorized by the percentage of PTL. Five categories with a 20 percent range, i.e., PTL-1 contains 81-100 percent PTL, PTL-2 contains 61-80 percent PTL, etc. were used. The percentages of PTL were derived from various soil series that constituted each association.

Map products were developed, compiled, and generated using the Automated Digitizing System (ADS) of the Kentucky Natural Resource Information System (KNRIS). Additional products included map and tabular breakdowns by county and by KDF Districts.

1/ The USDA sandard definition for forest land was used, i. e., "land that has soil capable of growing wood at the rate of 85 cubic feet or more, per year, under proper management (at culmination of mean annual increment), in natural stands and not in urban or built-up land uses or water."

Statewide results indicate that about 12 million acres of the state's 25 plus million acres are capable of being PTL. More importantly, approximately six million of the state's 12 million acres of land in forest cover is indicated as PTL. It was concluded that about one-half of the state's forest land is currently on land considered prime for timber production. From the tabular listings, acreages, and percentages can be reviewed and compared for individual counties and major physiographic regions of the state. From maps, PTL classifications for specific locations can be observed. Detailed PTL maps are not available for distribution.

These products were requested by the KDF for forestry resource planning and were generated for this purpose. Mapped products may be observed by contacting KDF or KDC in Frankfort, Kentucky or the USDA Forest Service in Doraville, Georgia.

15. Water Requirements For Forest Industry in Kentucky

An evaluation of water requirements for paper and pulp industries was conducted to indicate Kentucky streams with potential to accomodate a pulp or paper mill. (The candidate streams are listed on the following page). Key water demand and supply assumptions used in identifying and evaluating the streams were, (1) a maximum water consumption rate be limited to 20,000 gallons per ton of pulp or paper produced, (2) water should be sufficient to accomodate an 800 ton per day mill, and (3) a stream should supply 200 cubic feet of water per second to support a pulp or paper mill and accomodate other water requirements.

Although this report was prepared with assistance from knowledgeable primary and secondary forest products specialists and reviewed by the Technical Association of the Pulp and Paper Industry, it is limited in scope and all qualifying statements and considerations should be carefully reviewed to put the findings in proper perspective. However, the paper is suggested as a good initial assessment of the issue of water requirement for Kentucky forest industry.

16. Roadside and Railroadside Erosion

The report provides estimates of the amount and rate of excessive erosion on road and railroad areas for most of the counties in the state and for the Major Land Resource Areas. Data collected by SCS field personnel indicate that almost 2,100 acres of road and railroad areas in the state are eroding in excess of 200 tons per acre annually.

Two major land resource areas, MLRA 125 in eastern Kentucky and 122 in the southcentral section of the state, contain 78 percent of the state's 2,100 acres of excessively eroding road and railroad areas. The remaining 22 percent of the excessively eroding areas is fairly evenly distributed among the other three MLRAs. Counties having the most acres of eroding road areas include Christian, Pike, Floyd, Meade, Barren, Warren, Whitley, Lawrence, Crittenden, and Madison.

Kentucky streams with potential to accomodate a pulp or paper mill.

Stream	Location Within State	Streamflow Information (ft^3/s)
Mississippi River	Westernmost boundary	--
Ohio River	Entire northern boundary of state	11,000-25,000 minimum
Kentucky River	Middle Fork, confluence with Ohio River to Ervine, KY (Carroll, Owen, Henry, Franklin, Woodford, Anderson, Mercer, Jessamine, Garrard, Madison, Fayette, Clark, and Estill counties)	
Cumberland River (Central Kentucky)	South central Kentucky (Monroe, Cumberland Russell, Clinton counties) below Cumberland Lake	118-146 minimum on a few days/yr, otherwise excellent
Green River	Confluence with Ohio River into Hart County (Henderson, Daviess, Webster, McLean, Muhlenberg, Ohio, Butler, Warren, Edmonson, and Hart counties)	182 - 1,000 + minimum
Cumberland River	Confluence with Ohio River to Lake Barkley (Livingston and Lyon counties)	5,000 + minimum
Tennessee River	Western Kentucky - confluence with Ohio River to Kentucky Lake (McCrakcen, Livingston, and Marshall counties)	Abundant

17. Trend Analysis for Selected Crops in Kentucky by Major Land Resource Area (1969-1981)

This report provides data on the trends and projections by Major Land Resource Area and for the state for corn, soybeans, wheat, tobacco, barley, sorghum and hay crops. To conduct the study, thirteen years of annual agricultural production data and revisions from 1969 through 1981 were obtained from the U.S. Department of Agriculture Statistical Reporting Service. Regression analysis was performed to indicate where reliable trends exist so that they may be considered in agricultural planning activities.

The projections show only what would happen if a trend were to continue unconstrained into the future. Corn, soybeans and other hay regressions for harvested acreage and production showed all upward or increasing trends. Soybeans demonstrated the strongest relationship with the regression explaining 97 percent and 85 percent of the variation in acres planted and production, respectively. The trend shows acreage increasing more than 100,000 acres per year and production increasing by approximately 3 million bushels per year. Projections for the year 2000 show soybean acreage more than doubling.

Corn showed the second strongest relationship. The harvested acreage regression explains 77 percent of variation in acreage and the production regression explains 68 percent variation in production. Corn harvested showed increases of approximately 46,000 acres per year. Projections of harvested corn acreage indicate that by the year 2000 there could be 5 acres harvested for every 3 acres harvested in the 1979-1981 average. Hay crops other than alfalfa hay also satisfied the regression analysis criteria. The current year average of 1.39 million acres harvested is projected to increase to 2.35 million acres by the year 2000, nearly a 70 percent increase.

Trend and projections by Major Land Resource Area indicate by the year 2000 corn and soybean production in MLRA 120 (The Western Coalfields) will almost double the 1979-81 average. For MLRA 121, the Bluegrass, the trends are nearly identical to those for the state, that is corn, soybeans, alfalfa and other hay are expected to increase. The acreage of these crops are also projected to increase in the Pennyroyal area (MLRA 122). In the eastern Mountains, (MLRA 125), the trends shows an increase in the acreage and production of soybeans and alfalfa hay. For MLRA 134, the Purchase Area, the trends show a continued increase in soybean, sorghum and alfalfa hay.

SUMMARY OF RELATED RIVER BASIN STUDIES

Green River Basin

This report presented the results of comprehensive study of the water and related land resources in the Green River Basin in Kentucky and Tennessee. The 9,199 square mile basin encompasses all or portions of 31 west-central Kentucky counties and 3 counties in north central Tennessee. The predominantly rural basin is composed of about 94 percent agricultural and forest and 6 percent urban and water areas. The broad study objective is to promote orderly conservation, utilization, and management of the basin's water and land related resources.

Principal water and related land resource problems identified in the report result largely from:

a. Erosion exceeding desirable limits on 1.3 million acres of cropland, 385,000 acres of forest and 43,700 acres of surface mine land.
b. Sediment deposits in downstream creeks, rivers and lakes.
c. Flooding of agricultural and nonagricultural lands and properties.
d. Excess surface or subsurface water on agricultural lands.
e. Pollution of water by excessive sediment and waste materials.

The resource problems generate need for planning and using wise conservation, development, and management measures. Major needs on the agricultural and forest lands are for conservation and management measures to reduce erosion, conserve the productive base, and maintain and improve organic content and physical condition of soil. Some of the opportunities for decreasing the basic resource problems and improving the uses include:

1. Applying needed conservation and management measures on agricultural land.
2. Accelerating application of forest land treatment measures.
3. Making intensive use of existing programs and initiating new ones to reduce erosion and sediment.
4. Providing guidelines and assistance in implementing ways to achieve more equitable allocation of resources.

The recommended alternative provides for applying conservation land treatment and management practices to reduce erosion and runoff on over one-half of the 1.3 million acres of cropland and pasture needing treatment. Stabilization and reclamation measures proposed to reduce erosion, sedimentation, and related problems on coal mined land vary from shaping and leveling on most of the disturbed area to removing and stockpiling topsoil prior to extracting minerals. The disturbed material would then be replaced to approximate original topography.

Kentucky River Basin

Principal objectives of the basin study were to:

1. Identify the basin's water and related land resource problems and concerns.
2. Provide information on the quantity and relative quality of the basin's natural resources.
3. Identify and evaluate alternatives for reducing soil resource problems and meeting future food and fiber production needs.
4. Indicate opportunities and ways federal, state, and local agencies may alleviate the basic resource problems.

The Kentucky River Basin is located in east-central Kentucky and is completely within the state. It contains 17 complete counties and portions of 24 others. The upstream section of the 6,966 square mile basin is in Letcher County, near the Kentucky-Virginia state line. The basin extends 175 miles downstream from its origin in the southeastern Kentucky mountainous section to the Ohio River in Carroll County.

Kentucky River, originates in Lee County and flows in a northwesterly direction for about 160 river miles to its confluence with the Ohio River at Carrollton, Kentucky. It varies in width from a few feet in the upstream reaches to approximately 500 feet in the downstream section.

Major water and related land resource problems and concerns identified include excessive soil erosion and sedimentation, loss of prime farmland, flooding, water supply and quality and pollution, particularly solid waste. Soil erosion, one of the major resource problems, results primarily from runoff on disturbed and unprotected row crop, surface mine and construction areas.

Principal sediment sources are surface mine, roadbank, cropland, construction and development areas. The largest concentrated problem area is the eastern Kentucky coalfield. The sediment contributes to problems of infertile deposition, stream channel filling, swamping or ponding, and water pollution.

Approximately 5 percent of the basin area is subject to floodwater damages. The problem prevails throughout the basin but is more frequent on the narrow upstream tributaries than on the main stem and larger tributaries.

Prime Farmland being used for development purposes is becoming a concern and will be more so in the future. Principal areas of concern are the Bluegrass Area around Lexington and in the mountainous portion of the basin where prime land is scarce.

Water supply and quality problems are predominantly seasonal shortages, inadequate local sources, inferior quality, and inadequate facilities for storage, treatment or distribution. Surface water supplies are important to the basin since salinity and severe hardness are characteristic of groundwater supplies in several areas.

The concerns expressed regarding outdoor recreation indicate that many of the facilities and areas are inadequate or improperly located to satisfy needs. These concerns are expected to increase in the future unless additional facilities are developed for major populated areas.

Limited market opportunities for forest products is the major problem regarding forest. Other concerns are wildfire occurrence in the upper portion of the basin.

Nine alternative plans are discussed in this report. The alternative plans are directed primarily toward reducing the agricultural resource problems and meeting projected food and fiber needs for the year 2000. Most of the alternatives and plan elements could be implemented by federal, state, and local agencies under existing authorities if funding and staffing were sufficient.

APPENDIX B - RESOURCE BASE

HISTORY

Kentucky, the fifteenth to enter the Union and the first West of the Appalachians, became a state in 1792. The state, with 120 counties, covers an area of 25,862,000 acres or 40,409 square miles. It has varied terrain, ranging from wide floodplains on the Ohio and Mississippi Rivers to the rolling uplands in the central section and rugged mountains in the Eastern Appalachians. Elevations range from less than 300 feet above sea level along the Mississippi River in West Kentucky to over 4,000 feet in Harlan County near the Kentucky-Virginia border. The state's contrasting topography has resulted from natural forces which shaped its valleys, streams, mountains, and influenced its cultural patterns.

Although considered as one of the southeastern states, Kentucky is more on the border between the northern and southern states. On the north, it is bordered by Ohio, Indiana, and Illinois, with the Ohio River being the boundary. In the extreme western portion, the Mississippi River separates Kentucky from Missouri. The southern portion of Kentucky is bordered by Tennessee with the line beginning at the Mississippi River and extending eastward over 300 miles to Cumberland Gap. From here, the state is bordered by Virginia and the line extends in the easterly direction to the upstream section of the Big Sandy River. At this point, West Virginia borders Kentucky in the east and extends northeasterly to the confluence of the Big Sandy with the Ohio River. The state of Kentucky, while irregular in shape, extends over 300 miles from east to west and 100-150 miles from north to south.

Kentucky was originally a part of Virginia and North Carolina. The northern portion of the state was established in 1784 when Virginia gave up claim to lands south of the Ohio River. The state's southern boundary was formed in 1780, but was not made official until 1820. In 1799-1800, the eastern boundary was surveyed and demarcated. Kentucky's state boundaries were completed when the Jackson Purchase in the western section of the state was made in 1818.

The land of Kentucky had been inhabited or used by the indians as hunting grounds for many centuries. Some of the known indian tribes inhabiting or using the area were Cherokee, Catawba, Chickasaw, and Shawnee. In addition, the indians used the area for trails and trade routes which led from the Great Lakes country to the south. It was these trails that many of the early explorers and settlers followed into Kentucky and later westward onto the prairie states.

The early explorers and settlers were primarily British and French origin. British explorers entered Kentucky and Virginia by coming down and across the Ohio River. French explorers came up the Mississippi River and were interested mostly in furs and minerals. Daniel Boone and a hunting party entered Kentucky via the Cumberland Gap which was later to be used by settlers from Virginia and North Carolina. Pennsylvania imigrants came down and across the Ohio River.

Settlement of the state began around 1770 and gained momentum during the latter part of the century. The settlement rate was accelerated by the opening of the Cumberland Gap which provided a direct passageway for Virginia imigrants to enter Kentucky. It was estimated that over 100,000 settlers came across the Cumberland Gap between 1775 and 1800. Many of the emigrants settled in Kentucky, while others continued on or later moved westward. Most of the early settlements were located near streams which provided water for domestic use and a method of transportation. Fort Harrod in Harrodsburg was one of the first settlements in the state.

As the settlements increased, major efforts were directed toward clearing forests in the eastern and western section of the state and converting wild grasslands in the central section for crop and livestock production. Principal crops produced were corn, wheat, hemp, hay, and vegetables. The early agricultural activities were accompanied by the development of small-scale manufacturing, processing, and trade enterprises. These activities involved mostly fur, farm products, lumber, clothing, and furniture.

Development in the state continued until interrupted by the Civil War. Even though Kentucky was neutral, many of its citizens became members of the Union or Confederate forces. The war impacted the state as it was the site of several battles and experienced both human and property losses. After a recovery period, growth and development resurfaced but was slowed by depressed economic conditions during the latter part of the nineteenth and early twentieth centuries.

Agriculture, small wood, textile, and metal industries were the more important aspects of the economy. Coal mining in Eastern and Western Kentucky further stimulated the economy and accelerated development of railroads. These activities are still important, but the state has become more industrially oriented and diversified since World War II. The more notable industrial growth has been in metal, rubber, plastic, and textile enterprises, particularly in the major population centers. In fairly recent years, more high technology industries along with specialized trade and service establishments have located in the state. These developments have been paralled by improved transportation, education, and social institutions.

WEATHER AND CLIMATE

Kentucky's climate is temperate, with moderately cold winters and fairly warm summers. Each season is distinct and affected by weather changes that evolve from low and high pressure systems. Mean annual temperature is about 56° Fahrenheit with monthly temperatures ranging from 33° F in January to 77° F in July (Table B-1).

The growing season, which includes the number of days between the last damaging frost in the spring to the first one in the fall, averages about 185 days. This will vary from around 170 days in northeastern Kentucky to over 200 days in the western section. The first frost occurs in October and the last one in April.

Annual precipitation in the state averages about 47 inches (Table B-1). The precipitation varies from an average of 40 inches in the northeastern section to 50 inches in the southern portion. Monthly rainfall is fairly evenly distributed with October having the smallest amount and March the largest. Precipitation during the growing season, April through September, averages around 24 inches.

Snowfall varies widely, with an average season usually having about 14 inches annually. Thunderstorms occur throughout the year with the greatest number in the spring and summer months. Prevailing winds are from a southwesterly direction and normal velocities average 7 to 10 miles per hour.

LAND

The state of Kentucky encompasses 25,862,000 acres. This includes 25,196,600 acres of land and 665,100 acres of water.[1/] The 25,196,600 acre land area includes 22,866,200 acres of rural land, 1,205,900 acres of urban and built-up areas, and 1,124,800 acres of federal land. Rural land includes 5,924,300 acres of cropland, 5,879,800 acres of pasture, 10,158,200 acres of forest, and 894,000 acres in farmstead, feedlot, fence, mine, quarry, and related areas.[2/]

Physiographic Areas

Five physiographic areas occur in Kentucky and include:

1. Cumberland Plateau (Eastern Kentucky Coalfield). This area is in the mountainous section of eastern Kentucky and is part of the Appalachian Plateau. It includes 6.7 million acres or over 25 percent of the state's area. The region is a rugged mountainous area with narrow ridge tops, steep slopes, and entrenched valleys. Elevations range from around 1300 feet in the northern section to over 4000 feet in the southern portion. The mountainous area is underlain by Pennsylvanian sandstones, siltstones, shales, and coal. Except for deep to moderately deep and productive soils in the narrow bottom lands, most soils in the uplands are shallow, well-drained, and low in fertility.

1/ Compiled from data collected in the 1982 National Resource Study.

2/ For more detail discussion of land use, see pages 16 and 17 in Chapter II of this report.

Appendix B - Table 1

Climatological Data from Selected Stations by MLRA

Kentucky

MLRA	Station	Period of Record (years)	Temperatures: Mean Monthly: Jan - July (degrees fahrenheit)	Temperatures: Mean Annual (degrees fahrenheit)	Precipitation: Mean Annual (inches)
120					
	Henderson	(1921-1984)	33.0 - 77.9	57.0	43.73
	Madisonville	(1946-1984)	34.2 - 77.9	58.9	46.28
	Owensboro	(1895-1984)	33.2 - 78.3	57.1	44.79
121					
	Covington	(1946-1984)	33.9 - 74.6	55.8	40.14
	Louisville	(1933-1984)	32.5 - 77.6	56.2	43.56
	Lexington	(1878-1984)	31.5 - 76.0	54.9	45.68
122					
	Bowling Green	(1880-1984)	33.9 - 78.2	57.0	49.02
	Hopkinsville	(1895-1984)	33.2 - 78.1	57.0	49.16
	Somerset	(1948-1984)	34.3 - 75.0	55.6	50.41
125					
	Ashland	(1912-1984)	28.4 - 74.9	54.4	41.16
	Jackson	(1959-1984)	31.4 - 73.3	52.7	43.99
	Middlesboro	(1895-1984)	31.5 - 75.0	55.8	52.33
134					
	Mayfield	(1965-1984)	35.1 - 78.4	58.0	51.72
	Murray	(1924-1984)	35.1 - 78.8	57.8	50.47
	Paducah	(1946-1984)	34.3 - 79.3	57.9	45.79
State Annual			33.0 - 77.0	56.0	47.32

Source: Annual Summaries of Climatological Data for Kentucky, National Oceanic and Atmospheric Administration, US Dept. of Commerce, 1982-1984, Volumes 77-79.

2. Bluegrass Region. From north to south, this area extends from Covington to below Richmond and Danville. Louisville, the state's largest population center, is on the western boundary and Maysville and Morehead are in the eastern margin. The area is composed of three distinct sections, the Inner Bluegrass, Outer Bluegrass, and the Knobs. The Inner Bluegrass is in the central portion of the area and has gently, rolling lands. It is underlain by Middle Ordovician rocks, principally limestone, covered by relatively deep, fertile soils. The Outer Bluegrass surrounds the Inner Bluegrass and has topography that varies from gently sloping uplands to moderately steep, hilly sections. It is underlain by upper Ordovician limestones and shales, and has shallow to moderately deep soils. The Knobs area is characterized by conical hills which are erosional remnants of surrounding uplands. This area is underlain by Silurian, Devonian, and Lower Mississippian rocks of thick units of shale and limestone. The hills are steep and rough, but the valley floors are flat, fairly wide and poorly drained.

3. Pennyroyal Region (Mississippian Plateau). This region begins at the Ohio River and extends southward to the Tennessee border and then westwardly to join the Jackson Purchase area. It has varied terrain, ranging from sloping, relatively steep uplands and narrow valleys to undulating uplands and moderatley wide floodplains. Karst areas and large solution caverns formed by subsurface drainage are present in the central section of this region. The area is underlain predominately by limestone and sandstone. Soils in the steep, sloping uplands are shallow and low in fertility. The soils on bottomlands and gently sloping uplands are deep to moderately deep and productive.

4. Western Coalfields. This region is bordered by the Ohio River on the north and by the Pennyroyal area on the south, west, and east. Topography varies from wide floodplains along the major rivers to gently rolling uplands and relatively steep, sloping hills in certain sections. The area is underlain mostly by sandstone, siltstone, and shale. Soils in the floodplain are deep, fertile, and poorly to moderately well-drained. Except for the shallow, well-drained soils on the steeper slopes, most of the upland soils are moderately deep and fairly productive.

5. Jackson Purchase. This area is in the extreme western section of the state and is bordered by the Ohio, Mississippi, and Tennessee Rivers. It is a northern extension of the Gulf Coastal Plains and the landscape is covered mostly with Loess, a windblown silty material. The area has wide, fertile floodplains and gently, rolling uplands. Most of the soils are Loess silt, overlying coastal plain sand and gravel. Except for shallow soils on sloping or eroded areas, most of the soils are productive.

Major Land Resource Areas

Major land resource areas are geographically associated land resource units characterized by a particular pattern of soils, climate, water resources, and land uses. Identification of the land areas is important in area and statewide agricultural planning and valuable in interstate, regional and national planning. Information presented by the Major Land Resource Areas (MLRA) provide a basis for illustrating problems, concerns, and needs associated with resource use and availability. The six major land resource areas in Kentucky are:

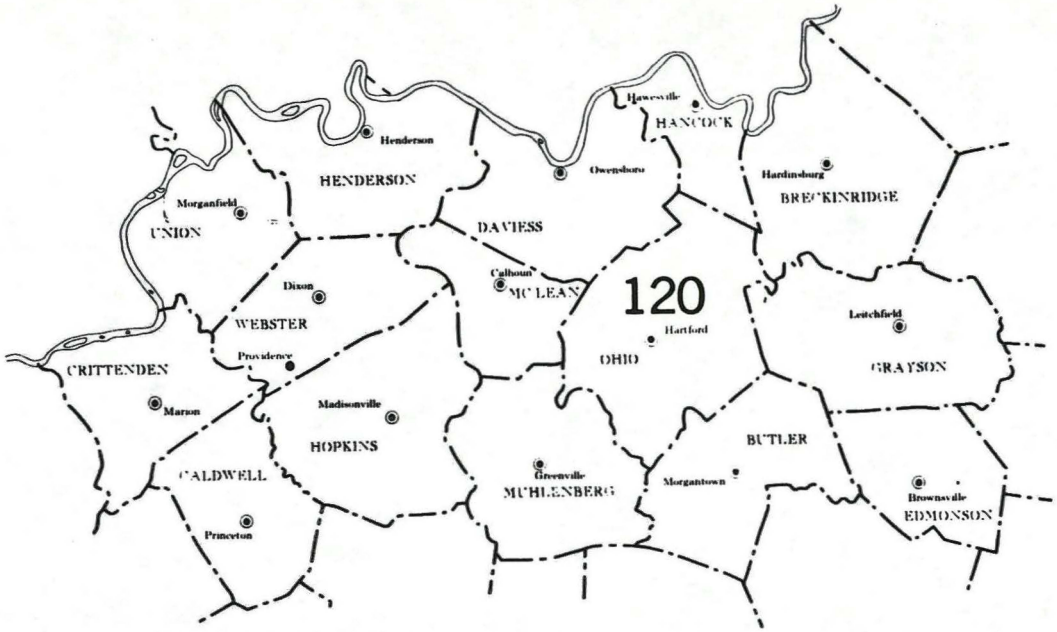
MLRA 120 - Kentucky and Indiana Sandstone and Shale Hills and Valleys
MLRA 121 - Kentucky Bluegrass
MLRA 122 - Highland Rim and Pennyroyal
MLRA 125 - Cumberland Plateau and Mountains
MLRA 131 - Southern Mississippi Valley Alluvium
MLRA 134 - Southern Mississippi Valley Silty Uplands

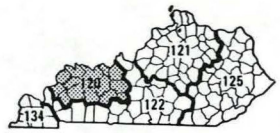
Major land resource area boundaries cross county and, in most cases, state lines. To facilitate planning and program administration, the MLRA data presented in certain parts of this report and in separate sub-reports are by county boundaries. In addition, only 108,000 acres or .005 percent of the 23,129,600 acres in MLRA 131 are in Kentucky. For planning purposes, the acreage in MLRA 131 is combined with that of MLRA 134, the dominant one in that section of the state. Each MLRA is discussed briefly to indicate its characteristics.

1. Kentucky and Indiana Sandstone and Shale Hills and Valleys - (Western Coalfields) (MLRA 120)

MRLA 120 encompasses 7,660,800 acres with 4,472,800 acres in Kentucky and 3,188,000 in Indiana (Plate I). The topography is mostly hilly with broad undulating ridgetops on major divides. Floodplain and terraces along the Ohio River and major tributaries are fairly wide and level to gently sloping.

Elevations range from around 300 feet above sea level on the Ohio River to over 600 feet on the higher locations. Average annual temerature is 58 degrees fahrenheit (F) with January the coldest month and July the warmest. Precipitation averages about 46 inches annually with the greater volume occurring in March and the lessor amount in October. Precipitation in the area is adequate for crop production in most years but in some years drought reduces yields and, in others, too much rainfall delays planting or interferes with harvesting operations. Water supplies are primarily from the larger streams and constructed reservoirs. Groundwater supplies are abundant in valley areas but are somewhat limited in most of the upland sections.





VICINITY MAP

PLATE I

120 - WESTERN KENTUCKY COAL FIELDS

MAJOR LAND RESOURCE AREA

KENTUCKY

0 10 25 50

APPROXIMATE SCALE - MILES

BASE MAP COMPILED FROM USGS NATIONAL BASE MAPS AND 1:500,000 STATE BASE MAP. AMBERS EQUAL AREA PROJECTION.

USDA SCS FORT WORTH, TEXAS 1983

Soils in the floodplain, terrace, and flat to gently sloping upland areas are generally productive and are suitable for crop production. Dominant soils in the bottomlands are Huntington, Nolin, Melvin, Stendal, and Cuba. Some of the upland soils are Grenada, Loring, Zanesville, Wellston, and Caneyville. Although some soils on the steeper-sloping areas are used for crops, they are more suitable for pasture, timber, and noncrop uses.

The 4,472,800 acre MLRA covers all or portions of 24 Kentucky counties. It includes 94,300 acres of water, 68,200 acres of federal land and 4,310,300 acres of privately-owned or state land. Land use in the rural land area for 1982 consists of 38 percent cropland, 20 percent pastureland, 36 percent forestland, and 6 percent other uses. Corn, soybeans, wheat, and tobacco are the major crops. The average size farm exceeds 200 acres with the largest number of farms being in the 1 -69 acre category.

2. Kentucky Bluegrass (MRLA 121)

MRLA 121 consists of 7,189,600 acres and is located in north and northcentral Kentucky and southern Indiana and Ohio (Plate II). Over three-fourths or 5.6 million acres of the MRLA is in Kentucky. Topography varies from broad gently rolling and moderately steep uplands to relatively narrow floodplains on many tributaries. Elevations range from about 600 feet above sea level on the Ohio River to around 1,040 feet on the higher ridge areas near Lexington.

Annual temperature averages about 56 degrees (F) with the 36 degree (F) January average being the coldest and the 77 degrees (F) average the warmest. Precipitation averages 45.5 inches annually. The greatest volume of precipitation is in March and the least amount occurs in October. Annual rainfall is generally sufficient for crop production, but droughts reduce yields in some years. Municipal and industrial water supplies are obtained from larger streams and constructed reservoirs. Some areas have rural water districts which provide water to smaller communities and rural sections. Farm ponds, streams, and cisterns are the primary sources for other rural areas and for livestock supplies. Groundwater supplies are limited in the upland sections but are available in the larger valley areas.

Soils in the upland areas are mostly fine to moderately fine textured and are formed in residuum from limestone, thin bedded shale or siltstone. The dominant soils are Maury, McAfee, Lowell, Nicholson, Fairmount, and Eden. Most are moderately deep to deep except for Fairmont and Eden. These are shallow, less productive and usually on steeper slopes. Principal floodplain and terrace soils are Nolin, Newark, Huntington, Elk, and Wheeling.

The 5,641,600 acre MLRA covers all or sections of 43 Kentucky counties. It includes 38,100 acres of federal land, 54,600 acres of water and 5,548,900 of privately-owned or state land. Rural land area use for 1982 includes 27 percent cropland, 48 percent pasture, 22 percent forest, and 3 percent other. Burley tobacco, corn, and hay are the principal crops. Beef cattle, dairy, and horses are important livestock enterprises in the area.

3. Highland Rim and Pennyroyal (Pennyroyal) (MLRA 122)

MLRA 122 covers 13,004,800 acres and is in four states, Alabama, Indiana, Kentucky, and Tennessee (Plate III). Kentucky has 6,360,800 acres or almost half of the MRLA acreage. Topography of the area is diversified with gently sloping to sloping uplands, moderately wide to narrow valleys, and steep walls and hillsides along entrenched stream channels. Elevations range from around 300 feet above sea level in deeper valleys to 1500 feet on the crest of the higher hills.

Average annual temperature in this area is about 57 degrees (F) with January at 37 degrees (F) the coldest month and July at 78 degrees (F) the warmest. Precipitation averages about 47 inches with January the wettest and October the driest month. Water supplies are obtained mostly from streams and reservoirs, many of which were constructed by the U.S. Army Corps of Engineers. These larger reservoirs usually provide flood control, power production, recreation and municipal water supplies. Springs, wells, and farm ponds are numerous and are used for water supplies.

Soils in the area are generally deep, well-drained, acid and have clayey subsoils. Some of the upland soils are Crider, Pembroke, Nicholson, Lawrence, Frederick, Mountview, Baxter, Weikert, and Zanesville. In bottomland areas, Huntington, Nolin, Newark, and Stendal are common. In portions of the area, limestone rock outcrops occur as well as numerous sinks which provide internal drainage.

The 6,360,800 acres includes all or portions of 36 Kentucky counties and has 254,200 acres of federal land, 197,000 acres of water and 5,909,600 acres of privately-owned or state land. Of the total, 5,622,500 acres are considered as rural land. This includes 1.8 million acres of cropland, 1.7 million acres of pasture, almost 2.0 million acres of forestland and 144,000 acres of other land. Small to medium size farms prevail throughout the area. Burley tobacco, corn, soybeans, and hay are the principal crops. Most of the intensive production of corn, wheat, and soybeans is in the western and central section. Hay and pasture to support beef cattle operations are the primary crops in the eastern section. Dairying is an important enterprise in some of the area counties.

4. Cumberland Plateau and Mountains (MLRA 125)

MRLA 125 encompasses 15,769,600 acres in Alabama, Kentucky, Tennessee, Virginia, and West Virginia (Plate IV). Kentucky has 7,858,800 acres or about one-half of the total area. Topography of the mountainous area is depicted by a series of long steep side slopes between narrow ridgetops or crests and narrow flood plains. Elevations range from around 650 feet above sea level along the Ohio River to almost 4000 feet on the higher peaks near the Virginia-Kentucky border.

VICINITY MAP

PLATE II

121 - BLUEGRASS

MAJOR LAND RESOURCE AREA

KENTUCKY

0 10 25 50

APPROXIMATE SCALE - MILES

BASE MAP COMPILED FROM USGS NATIONAL BASE MAPS AND 1:500,000 STATE BASE MAP. AMBERS EQUAL AREA PROJECTION.

USDA SCS FORT WORTH, TEXAS 1982

MAY 1982 4-R-33970 - 4

VICINITY MAP

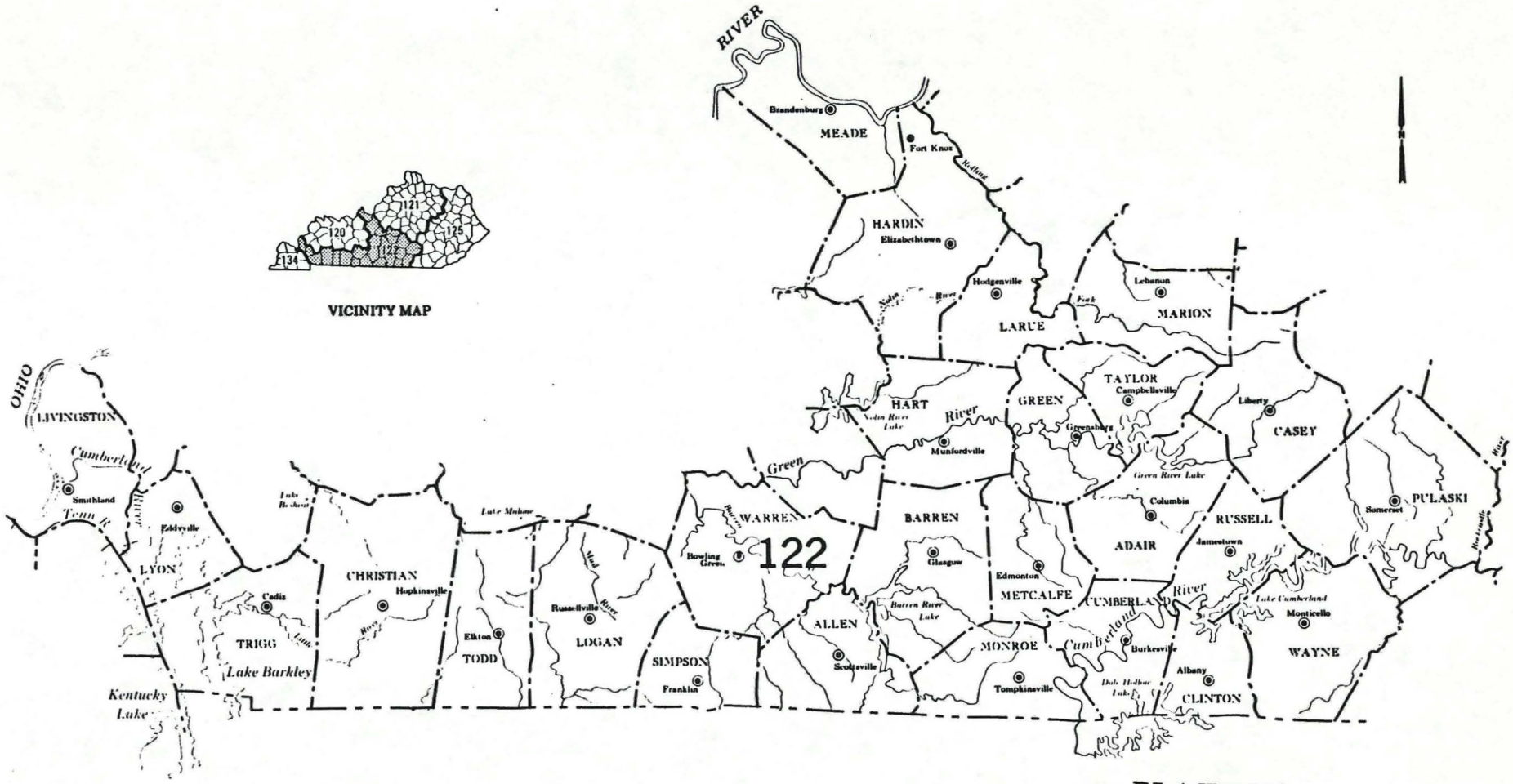


PLATE III

122 - PENNYROYAL

MAJOR LAND RESOURCE AREA

KENTUCKY

0 10 25 50

APPROXIMATE SCALE - MILES

BASE MAP COMPILED FROM USGS NATIONAL BASE MAPS AND 1:500,000 STATE BASE MAP. AMBERS EQUAL AREA PROJECTION.

USDA SCS FORT WORTH TEXAS 1982

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

VICINITY MAP

125 - EASTERN KENTUCKY COAL FIELDS

MAJOR LAND RESOURCE AREA

KENTUCKY

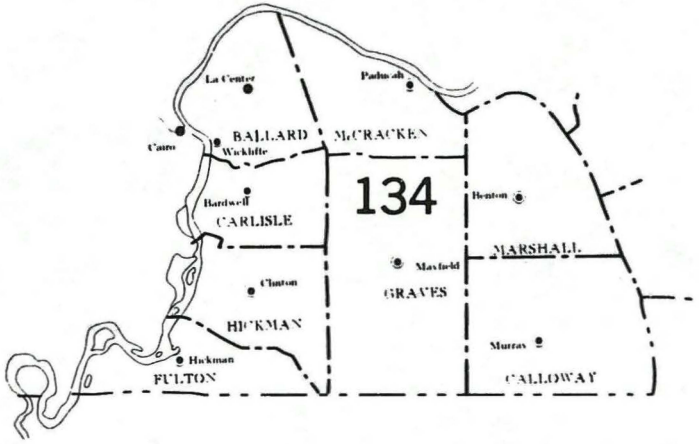
0 10 25 50

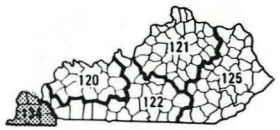
APPROXIMATE SCALE - MILES

BASE MAP COMPILED FROM USGS NATIONAL BASE MAPS AND 1:500,000 STATE BASE MAP. AMBERS EQUAL AREA PROJECTION.

USDA SCS FORT WORTH, TEXAS 1982

MAY 1982 4-R-33970 - 5





VICINITY MAP

PLATE V

134 - PURCHASE AREA

MAJOR LAND RESOURCE AREA

KENTUCKY

0 10 25 50

APPROXIMATE SCALE - MILES

BASE MAP COMPILED FROM USGS NATIONAL BASE MAPS AND 1:500,000 STATE BASE MAP. AMBERS EQUAL AREA PROJECTION.

USDA SCS FORT WORTH, TEXAS 1982

Precipitation in the area averages about 45 inches annually. It is generally evenly distributed thoughout the year, but prolonged dry periods do occur. Water supplies are sufficient for domestic needs except during the dry periods when supplies become limited in certain sections. Most of the domestic water is provided by streams, reservoirs, wells, and cisterns. Groundwater supplies are available along the major tributaries, but are relatively scarce in the upland sections. Annual temperature in the area averages about 57 degrees (F), with January being the coldest month and July the warmest.

Most of the soils are medium to fine textured and gravelly. Upland soils are predominately Jefferson, Shelocta, Latham, Gilpin, Berks, and Dekalb. Bottomland and terrace soils include such as Bonnie, Pope, Nolin, and Allegheny. The flood plain soils are productive but are limited along the narrow entrenched streams present in most of the area. Except for agricultural use of soils on the flatter ridge and less sloping areas on the western fringe section of this area, soils on the steep slopes are unsuitable for crop production.

MLRA 125 with 7,858,800 acres is the largest in Kentucky. This area covers all or portions of 36 Kentucky counties. It consists of 7,054,000 acres on privately or state-owned land, 758,700 acres of federal land, and 46,100 acres of water. A total of 6,727,800 acres is classed as rural land of which about 6 percent is cropland, 11 percent pasture, 78 percent forest, and 5 percent other land. Agricultural activities are limited primarily to the bottomland and flatter ridge sections on the western edge of this area. A high proportion of the farms are small and the crops are limited to tobacco, corn, and hay. Beef is the principal livestock. Lumber and coal mining activities are important enterprises in the area. A substantial portion of this Appalachian area is in the Daniel Boone National Forest.

5. Southern Mississippi Valley Silty Uplands (Purchase Area) (MLRA 134)

This MLRA is in five states - Arkansas, Kentucky, Louisiana, Mississippi, and Kentucky and covers 12,704,000 acres. Eleven percent or 1,419,700 acres of MLRA 134 is in Kentucky (Plate V). It includes all or portions of the eight counties located west of the Tennessee River. Topography varies from rolling and relatively steep hills to gently sloping broad ridge areas. Floodplains are comparatively narrow on the smaller upstream tributaries but are relatively wide on the larger streams, especially along the Ohio and Mississippi Rivers. Elevations in the area range from around 300 feet above sea level to 600 feet on the higher peaks.

MLRA 134 receives about 48 inches of precipitation annually. It is reasonably well distributed with the greater volume in the spring and the lessor amount in the fall. Moisture is generally sufficient for crop production except during prolonged dry periods. Surface and groundwater supplies are abundant throughout the area. Domestic water is obtained mostly from streams, reservoirs, and wells. Kentucky Lake along with the Ohio and Mississippi Rivers also provide water for recreation and transportation in the area.

This area is part of the northern extension of the east Gulf Coastal Plains. During geological formation, the area was covered with gravel, sand, silt, and clay. As time progressed, geologic erosion removed much of the deposits leaving an irregular landscape covered mostly with Loess, a windblown silty deposit. The Loess deposits are distributed throughout the area, ranging in depth from a few inches on the steeper slopes to several feet in the flood plains. Brandon, Loring, Memphis, and Lexington are some of the soils on the rolling and steep slopes. These, along with Grenada and Calloway, are also present on the more level uplands . Collins, Vicksburg, Commerce, Iuka, Falaya, and Waverly, are the dominant soils in the bottomland areas.

The area, referred to as the Purchase, has 3,400 acres of federal land, 44,800 acres of water, and 1,371,500 acres of privately-owned and state land. Of this, 1,279,400 acres are classed as rural land and includes 725,500 acres of cropland, 200,000 acres of pasture and 44,400 acres of other land. This is largely a cash-crop area with corn, wheat, and soybeans being the major crops. The average size farm is about 200 acres but there are several operations with 1,000 or more acres. Most of the commercial farms are specialized grain farms and have little to no livestock.

6. Southern Mississippi Valley Alluvium (MLRA 131)

This MLRA covers 23,129,600 acres and is mostly in Arkansas, Mississippi, and Missouri. Kentucky only has 108,300 acres in this area, most of which is the Mississippi River floodplain and bluff area. The area in Kentucky includes 22,400 acres of water, 2,200 acres of federal land and 83,700 acres of privately-owned land. About 83,000 acres of this area is classed as rural land and includes 56 percent cropland, 11 percent pasture, 32 percent forest, and 1 percent other land.

The area is similar to MLRA 134 in many aspects but possesses differences sufficient to be excluded. The most apparent difference is that MLRA 131 is dominately a level floodplain with well to poorly drained soils. Since the acreage is relatively small, MLRA 131 is for this study included with MLRA 134.

WATER QUANTITY AND QUALITY

Water is one of Kentucky's most valuable resource. It is derived from an average annual precipitation of 47 inches. Approximately three-fifths of the precipitation is consumed through evaporation and transpiration. The remaining two-fifths constitute the average annual runoff of about 19 inches. It is this portion that enters the stream system, flows into reservoirs, and seeps into underground storage.

The average annual precipitation is normally sufficient to meet most of the water supply needs in the state. However, droughts and water shortages occur because of seasonal variation and uneven distribution of rainfall, resulting in subsequent low streamflows, decreased reservoir levels, and inadequate soil moisture.

Annual precipitation in the state ranges from an average of about 40 inches in northern counties to over 50 inches in the southern. On a monthly basis, March and January with an average of five or more inches of precipitation are the wettest months and October and September with two to three inches are the driest. Average annual runoff in Kentucky ranges from less than 15 inches in the norther portion to around 24 inches in the southern section. While paralleling closely the quantity of precipitation, the volume and variation in runoff are also influenced by vegetative cover, soil, topography, land use and other factors.

Surface Water

Kentucky has about 665,100 acres of surface water which amounts to 2.6 percent of the total area in the state. This includes 459,200 acres of water in areas over 40 acres in size and in streams greater than one-eighth mile wide (Table B-2). Approximately 206,000 acres are in areas less than 40 acres and in streams less than 660 feet wide. Most of the smaller water areas are water supply reservoirs, flood control structures, farm ponds and smaller streams. The larger water areas are Kentucky Lake, Barkley Lake, Cumberland Lake, Dale Hollow Lake, Barren River Reservoir, Cave Run Reservoir, and Green River Reservoir and the principal rivers. Most of the larger lakes have over 7,000 surface acres and provide storage for flood control, recreation, hydroelectric power production and municipal water.

The Jackson Purchase area, MLRA 134, in West Kentucky has the highest proportion of area in water. This MLRA has over six percent of the 1.6 million acres in water. Both the 6.63 million acre Pennyroyal Area (MLRA 122) and the 4.02 million acre Western Coalfield Area (MLRA 120) have over three percent of the areas in water. The Bluegrass Area (MLRA 121) and the Cumberland Plateau and Mountains (MLRA 125) have the least proportion of the areas in surface water.

Approximately 95 percent of the state's 25.8 million acre is in the Ohio River Basin. The remaining five percent is in the Mississippi River Basin in the Western section of the state. The Ohio River forms the northern boundary of the state except for a section in Western Kentucky. It extends from east of Ashland, Kentucky to its confluence with the Mississippi River near Wickcliffe, a river distance over 650 miles. The river is a major navigatible stream, providing transportation for materials, goods, and produce to and from Kentucky. It is also a major provider of municipal and industrial water to cities and towns located near by.

Appendix B - Table 2 - Surface Area of Water by MLRA
Kentucky 1/

MLRA	Large Water Areas 2/	Small Water Areas 3/	Total
	acres		
120	94,300	38,400	132,700
121	54,600	63,300	117,900
122	197,000	39,500	236,500
125	46,100	49,400	95,500
134 4/	67,200	15,300	82,500
Total	459,200	205,900	665,100

1/ Compiled from National Resources Inventory data for Kentucky, 1982.

2/ Includes water in areas over 40 acres in size and in streams more than 660 feet wide.

3/ Includes water in areas less than 40 acres in size and in streams less than 660 feet wide.

4/ The acreage in MRLA 131 has been included in MRLA 134.

The Cumberland River on which Lake Barkley Dam was constructed and the Tennessee River on which the Kentucky Lake Dam was built are the largest rivers flowing through the state. However, the larger section of the drainage area of these rivers are outside the state. Major rivers with drainage areas totally within the state are the Green, Kentucky, Licking, and Salt. Big Sandy River which forms part of the eastern boundary of Kentucky has part of its drainage area outside the state. Several other streams with significant drainage areas flow into the Kentucky, Green, and Cumberland Rivers. In addition, some large tributaries flow directly into the Ohio and Mississippi Rivers.

All major rivers and many tributaries are used for municipal and industrial water supplies. It is estimated that the streams and other surface sources provide around 78 percent of the water used for municipal, industrial, and agricultural purposes.

Groundwater

Groundwater availability varies throughout the state and is closely related to the existing geologic formation. Areas with a more abundant supply of groundwater are those underlain by alluvium along the major streams and those having sand and clay formations in the lower upland sections. These areas are mostly in the Jackson Purchase (MLRA 134), Western Coal Fields (MLRA 120), and the Southwestern section of the Pennyroyal (MRLA 122). Groundwater supplies are abundant in most all lower lying areas along the Ohio, Mississippi, Green, Cumberland, and other major tributaries. Wells drilled in the above areas usually yield from 1,000 to 1,700 gallons per minute (g.p.m.).

Areas with favorable groundwater supplies but significantly less than the higher yielding sections include the Eastern Pennyroyal (MLRA 122), lower elevations in the Cumberland Plateau and Mountains (MLRA 125), and the Inner Bluegrass Regions (MLRA 125). Yields from wells in these areas range widely from 50 to 1,000 g.p.m. Wells drilled into thick limestone or alluvium normally yield sufficient water for rural domestic use.

Areas with the less favorable groundwater supplies include those underlain by thin limestone inner bedded with shale and those having underground layers of porous rock. These areas are primarily in the outer Bluegrass and the western section of the Big Sandy River Basin. Wells in these areas often are undependable for domestic use as they produce from zero to less than 100 g.p.m.

In general, the availability of groundwater is more abundant in the western section of Kentucky and decreases in quantity as move eastward. Domestic use of groundwater also decreases as move from west to east across the state. Groundwater which provides about 22 percent of the total water withdrawn for public use, is an important source in rural areas, particularly where surface supplies are limited or not economically feasible. Drilled wells and springs are the major providers of underground water in the state.

Water Quality

Water quality in Kentucky varies by area and by season and depends largely upon local geological conditions, streamflow characteristics, and quantity of waste water and effluent material discharged. The most significant and widespread natural pollutants are sediment and dissolved minerals. Man's activity also contributes soluable materials to water. This pollution consists primarily of waste discharges from domestic, industrial and agricultural uses; sediment, dissolved minerals, and diffused wastes in runoff from urban, industrial, mining, and agricultural lands; sediment produced from timber harvesting operations and from sediment transported by runoff from development areas. Changes in stream regimen from upstream water retardation or diversion facilities, erosion control measures, fertilization, and irrigation could increase the concentration of materials to affect water quality.

Although affected by turbitity after heavy rainfalls and concentrations of dissolved minerals during low flows, the quality of water in many of Kentucky's smaller streams and reservoirs is good and suitable for most uses. The streams and reservoirs are distributed throughout the state with the greater number being in vegetated tributaries of the Cumberland, Green, and Salt River Basins. Most of the smaller streams and reservoirs also are in areas unaffected by major urban, industrial, mining, and agricultural developments.

The quality of water in many of the states larger streams and reservoirs, like the small ones, is rated as good 1/. While affected by contaminants, particularly during low flow periods, the base stream flow or reservoir capacity is generally sufficient to assimilate the residual materials. Major rivers considered as having good water quality include Upper Cumberland, Salt, and Tennessee. Several larger tributaries on these and other major rivers in the state, especially in the less intensive industrialized or agricultural areas, also have good quality water. 2/

Water Quality Problems

Water quality problems prevail throughout the state but vary in type, magnitude and by area. The more noticeable problems are those occurring from accumulated deposits of solid waste materials in streams, on banks and in upper reservoir sections; excessive sediment in suspended form or deposited in streams and lakes; and high levels of dissolved chemicals and wastewater that cause water discoloration and damage to aquatic and adjacent vegetative life. The less visible but significant water quality problems include those caused by heavy concentrations of dissolved minerals in groundwater, discharges of contaminants directly into streams, and runoff transporting pollutants from waste material deposits, agricultural, industrial, and municipal areas.

While localized and usually confined to small areas, several streams are affected from discharges of municipal sewage, industrial waste or urban runoff. The affected steams are mostly in the developed valleys of eastern Kentucky and in or below certain towns or sections of larger cities in the central and western portion of the state. These problems usually occur when inadequately treated waste is discharged into streams during seasons of low flows or when runoff from intense rainfall transports contaminants from discarded materials to the stream system. Individually, these problems usually affect only small areas but collectively they may cause serious degradation in larger downstream sections. Water quality degradation in larger areas is related primarily to discharges of industrial water and runoff from urban, mining, agricultural, and other larger-scale developments.

1/ Source: Kentucky Report to Congress on Water Quality, 1980-81, Division of Water, Kentucky Natural Resources and Environmental Protection Cabinet.

2/ While depending upon use, water quality is considered good or satisfactory if is satisfies the U.S. Public Health Service standards and the criteria in the state water quality regulations (401 KAR 5:026 and KAR 5:031)

Water Pollutants by Major River Basins

While brief, the discussion here is intended to highlight some of the water quality pollutants in the major river basins of Kentucky. In the Big and Little Sandy Rivers and Tygarts Creek area of eastern Kentucky, sediment industrial waste, coal mining, oil drilling, and municipal sewerage have adversely affected water quality. Streams in the upper section of the Licking River area are also affected by sediment and chemicals from coal mining and oil drilling activities. In the central and lower section of this area, agricultural runoff, sewage, and indistrial discharges contribute sediments, nutrients, and chemicals to streams.

The upstream portion of the Kentucky River area is affected by coal mining and oil drilling operations. These operations contribute sediment, chemicals, and brine to streams, resulting in localized damage to acquatic and vegetative life and degradation of downstream water supplies. In the central part of this area, discharges from municipal treatment plants degrade water quality by adding nutrients and depleting the oxygen level in streams.

The headwater section of the Cumberland River, like the Kentucky River is affected by coal mining operations. Water quality in this area is altered by drainage from underground coal mines, runoff from surface mining areas and oil drilling operations. As in other areas of the state, the base flow in many tributary streams is often insufficient to adequately assimulate waste loads. Consequently, discharges of excessive municipal sewage and waste into the streams impact water quality. While the central and lower section of the Cumberland area experience pollution from urban areas and agricultural operations, the magnitude is considerably less than the upper portion.

Agricultural runoff and domestic sewage are the major pollutants in the Salt River area. Except for discharges of waste in developed areas, the other pollutants are sediment and pesticides from agricultural and disturbed lands.

Water quality in the Green River area is affected by coal mining, oil drilling, domestic waste and agricultural operations. The Green River area contains most of the west Kentucky coal producing counties. Both surface and subsurface mining are conducted with surface being the most dominant method. Surface runoff and underground drainage from the mining areas contribute sediment and chemicals to streams, severely impacting water quality. Oil drilling operations also contribute brine to the lower area streams. These activities, along with intensive agricultural operations in certain sections, have resulted in heavy siltation, high concentrations of acids, and, in areas, chlorides and nutrients. Pollution occurs in the central and upper portion of the Green River basin, but significantly less in magnitude.

The Tradewater River area, similar to lower Green River, is affected by sediment and chemicals from mining activities. The river is heavily silted and water is highly acidic. As compared to the quality in Tradewater River, the adjacent lower Cumberland River area has comparatively minor degradation problems. The quality in this area is affected to some degree by agricultural runoff, municipal waste, and industrial discharges.

Water quality in the Tennessee and Mississippi River areas is affected similarly; that is by sediments and/or nutrients from domestic waste and runoff from urban and agricultural areas. Industrial discharges from plants in the larger urban centers are also a concern in the Tennessee River drainage. 1/

FOREST

The area of forest land in Kentucky has changed little during the past quarter century. According to the last Forest Service (FS) survey, woodland occupies 12.2 million acres. However, the forest land is unevenly distributed as eastern Kentucky, which is over 80 percent forested, has one-half of the state's acreage. Woodland accounts for 25 percent of land area in the Bluegrass Region, 34 percent in western Kentucky, and 46 percent in the Pennyroyal Region. Almost 98 percent of the forest land is classified as commercial forest and two percent is noncommercial.

Forest in Kentucky are predominately hardwoods as softwoods account for only 7.5 percent of the total timber volume. Data in the Forest Survey shows that the oak-hickory type accounts for 83 percent of the forest types on commercial forest land. Other important types, including over one million acres of the oak-pine type, are loblolly-shortleaf, maple-birch-beech, and elm-ash-red maple. White oaks are the most prevalent group of forest species accounting for 22.7 percent of the total volume statewide.

About 47 percent of the commercial forest land area supports sawtimber stands. These stands, which include trees with a five inch or larger diameter measured at 4-1/2 feet above ground level, constitute more than 50 percent of the total basas-area stocking. Poletimber stands occupy 25 percent of the area and seedling and sapling stands occupy the remaining 28 percent.

A study of forest-land owners indicates that 455,000 individuals, groups or corporations own one or more acres of the 11 million acres of private commercial forest land. Thirty percent of these owners who reported harvesting timber from their land owned by approximately 55 percent of the total commercial forest area.

In the 1963-76 period, the volume of growing stock increased 23 percent and the volume of sawtimber increased 24 percnet. The Total of growing stock in Kentucky is estimated at 11.4 billion cubic feet. for an average of 962 cubic feet per acre of commercial forest land. The sawtimber portion of the growing stock totals 27.5 billion board feet, which is equivalent to 2,315 board feet per acre.

1/ For more detail information on water quality, refer to the Kentucky Report to Congress on Water Quality, 1980-81, prepared by the Division of Water, Frankfort, Kentucky.

Under the authority of the McSweeney-McNary Forest Research Act of 1928, as amended, and the Renewable Natural Resource Act of 1974, as amended, the USDA FS conducts periodic inventories and takes evaluations of the forest resources of all states for the purpose of providing up-to-date information on the nation's forest resources. Inventories of Kentucky's forest resources have been made by the FS three times in the past quarter century. The last FS survey results were published in 1978 and they are still considered the most reliable and comprehensive inventory of forest resources. A detailed statistical and analytical report is available for each Kentucky forest resource survey. It can be obtained by contacting the Kentucky Division of Forestry at Frankfort, Kentucky, or the Northeastern Forest Experiment Station of the USDA Forest Service at Broomall, Pennsylvania.

MINERALS

Minerals are important natural resources in Kentucky, with coal being the most important economically. Other minerals currently marketed are limestone, petroleum, natural gas, fluorspar, sand, gravel, and lead.

Coal

Kentucky is one of the leading coal producing states in the nation. In 1981, coal production exceeded 157 million tons. The estimated value of the 157 million tons approaches four billion dollars and the industry provided employment to over 50,000 workers.

As shown in Table B-3, about three-fourths of the coal produced in Kentucky in 1981 was from the eastern Kentucky coal fields. This section, which is part of the Appalachian Coal region, includes all or part of 31 Kentucky counties. Of the 117.9 million tons mined in eastern Kentucky, over 55 percent was from Pike, Martin, Harlan, Perry, and Knott counties. Approximately 53 percent of the coal produced in the eastern coal fields was mined by underground (deep mining) methods. Strip mining, auger, or a combination of stripmining and auger was used for the remaining 47 percent.

The Western Coalfields, which are part of the Eastern Interior Coal Region, include 18 Kentucky counties. Coal production in western Kentucky amounted to 39.7 million tons in 1981. Five counties, Muhlenberg, Hopkins, Ohio, Union, and Webster counties, accounted for 83 percent of the coal mined in the Western Coalfields. Surface mining methods, predominately stripping, was used to mine about 55 percent of the coal in this section.

Other Minerals and/or Products

Other important minerals and/or products produced or processed in Kentucky are limestone, oil, gas, fluorspar, sand, gravel, lead, and clay. Except for fluorspar, lead and clay, the other minerals and products are distributed throughout most of the state. For information on the location and quantity of these and othe minerals produced in Kentucky refer to Annual Report of the Kentucky Department of Mines and Minerals, Commonwealth of Kentucky, 1981, Kentucky Geological Survey.

Appendix B - Table 3 - Coal Production by Type of Mining for Selected Counties in 1981

Kentucky

County	Coal Mining Methods		
	Underground	Surface	Total
	tons		
Eastern KY			
Bell	2,295,515	4,521,289	6,546,804
Breathitt	150,140	6,326,715	6,476,855
Clay	1,200,306	1,584,813	2,785,119
Elliott	8,000	657,243	665,243
Floyd	4,826,458	1,702,307	6,528,765
Harlan	10,584,379	965,606	11,549,985
Johnson	435,120	446,703	881,823
Knott	4,043,129	3,473,857	7,516,986
Knox	270,898	1,126,522	1,397,420
Laurel	342,050	1,991,279	2,333,329
Lawrence	----	738,171	738,171
Leslie	2,829,651	2,504,370	5,334,021
Letcher	4,182,474	2,623,629	6,806,103
Magoffin	561,959	6,635,729	4,197,688
Martin	5,168,528	9,070,356	14,238,884
McCreary	676,683	335,098	1,011,781
Perry	2,519,643	6,446,932	8,966,395
Pike	21,627,129	2,764,632	24,391,761
Wayne	----	596,004	596,004
Whitley	276,435	1,892,475	2,168,910
Other 1/	29,700	2,721,700	2,751,400
Subtotal	62,028,017	55,855,430	117,883,447
Western KY			
Butler	36,691	1,829,875	1,866,566
Daviess	----	1,212,968	1,212,968
Henderson	652,671	----	652,671
Hopkins	2,890,814	6,033,324	8,924,138
Muhlenberg	3,031,806	6,268,341	9,300,147
Ohio	1,116,454	5,145,906	6,262,360
Union	5,779,492	70,068	5,849,560
Webster	4,263,249	832,189	5,095,438
Other 1/	----	512,209	512,209
Subtotal	17,771,177	21,904,880	39,676,057
Total	79,799,194	77,760,310	157,559,504

1/ Other includes ten counties in eastern Kentucky and five in the western section that produced less than 500,000 tons.

2/ Source: Annual report of the Department of Mines and Minerals, Commonwealth of Kentucky, 1981.

RESOURCE USES

The use of land, water, and related resources has been highlighted in previous sections of this chapter and in Chapter 1. In addition, two reports prepared as part of this study contain data that depict the agricultural use of resources.[1/]

Kentucky comprises a land area of 25,196,900 acres. Of this, 22,866,200 acres are classed as rural land and includes 5.9 million acres of cropland, 5.9 million acres of pasture, 10.2 million acres of forest, and 894,000 acres of land in farmsteads, mines, quarries, and related uses. Urban and built-up areas include 1,205,900 acres and land in federal ownership account for the remaining 1,124,800 acres.

Principal agricultural crops produced in the state are corn, soybeans, wheat, hay, and tobacco. In 1982, these along with other crops produced accounted for 57 percent of the 2.37 billion dollar market value of all agricultural products. Livestock and livestock products, primarily beef, dairy, and hogs, accounted for the remaining one billion dollar value.

Agricultural crop and pasture production is distributed throughout the state, with most of the corn, wheat, and soybean acreage being in western Kentucky in MLRA 120, 134, and the western section of 122. Although corn, wheat, and soybeans are produced in central Kentucky in MLRA 121 and the eastern section of MLRA 122, most of the acreage in these areas is used for hay, pasture, and tobacco. In the eastern section of the state, MLRA 125, agricultural activities are limited and are confined primarily to hay, pasture, and tobacco production in the narrow valleys and ridgetops.[2/]

The 1.2 million acres in urban and built-up areas are distributed throughout the state, with the most acreage being in the larger population centers. The Bluegrass Area, MLRA 121, contains the larger populated areas of Louisville, which had a population of almost 300,000 in 1980, Lexington (204,165), Covington-Newport (71,161), Frankfort (25,923), and Richmond (21,705). The second largest populated area, MLRA 125 in eastern Kentucky includes Ashland (27,064), Middlesboro (12,251), Corbin (8,025), and Morehead (7,759). MLRA 122, the Pennyroyal Area, contains Bowling Green (40,450), Hopkinsville (27,318), Elizabethtown (15,380), Radcliff (14,519), and Glasgow

[1/] For additional agricultural data, see the reports available upon request from SCS, 333 Waller Avenue, Lexington, KY 40504, which are entitled, "Kentucky's Agricultural Economy by Major Land Resource Area", and "Acreage, Production, and Yield Data for Selected Crops by County and "MLRA".

[2/] See the reports on Acreage Production and Yield Data and Kentucky's Agricultural Economy referred to in the previous footnote for more detail on crop production, farm structure, and the composition of the population in the state.

(12,958). In MLRA 120, the Western Coalfields, Owensboro (54,450), Henderson (24,834), Madisonville (16,979), and Greenville (4,631) are the largest populated areas. Paducah (29,315), Murray (14,248), and Mayfield (10,705) are the largest populated areas in MLRA 134, the Purchase Area.

Population estimates in 1980 show Kentucky with 3,660,257. Of this 1,861,663 are classed as urban and 1,798,594 as rural. The rural population included 245,998 classed as farm and 1,552,596 classed as nonfarm. Approximately 48 percent of the state's population is in MLRA 121, 26 percent in MLRA 125, 16 percent in MLRA 122, 10 percent in MLRA 120, and 5 percent in MLRA 134.[1/]

FISH AND WILDLIFE RESOURCES

Principal fish and wildlife resources of Kentucky consist of an estimated 201 species of fishes, 45 species of amphibians, 54 species of reptiles, 65 species of mammals, and 275 species of birds that are either permanent or part-time residents of the state, or regularly visit it each year. Another 38 species of birds appear here occasionally.

The distribution of these various kinds of fish and wildlife within the state reflects the distribution of the types of habitat they require. For the terrestrial species some 23 million acres of habitat are available and includes about 26 percent cropland, 26 percent pastureland, 43 percent woodland, and 5 percent rural land used for miscellaneous purposes. In the western two-thirds of the state these land uses are fairly well interspersed and it is here that openland forms of wildlife such as the cottontail rabbit, bobwhite quail, and mourning dove are most plentiful. Forest species, particularly the ruffed grouse, wild turkey, and gray squirrel are concentrated in the mountainous eastern one-third of the state where woodland dominates the landscape. The wild turkey and gray squirrrel are also found in substantial numbers in the hillier wooded portions of the west-central part of the state along the southern edge of the Western Coal Field physiographic region, and in the woodland between Kentucky Lake and Lake Barkley. The white-tailed deer, whose habitat requirements are intermediate between those of the openland and woodland species, is found locally throughtout the state where the habitat is suitable.

The extreme western portion of Kentucky west of the Cumberland River is within the Mississippi flyway for migrating waterfowl and is regularly used by both ducks and geese. Much of the bottomland throughout the area is flooded each winter. This makes it particularly attractive to ducks. The prevalence of grain farming in the area also makes it a concentration area for geese.

1/ See Kentucky: Agricultural Economy by Major Land Use Area for more detailed information on population, distribution, and composition.

Wood ducks nest along tree-bordered streams throughout the state and migrating waterfowl stop to rest and feed on lakes and ponds from one end of the state to the other, especially during the spring of the year. An estimated 32 species of waterfowl are known to visit Kentucky, but only 19 are considered common transients or winter residents.

Habitat for other aquatic wildlife and fishes consists of approximately 14,000 miles of streams, more than 200,000 acres of large flood control reservoirs, over 5,500 acres of small lakes, and about 32,500 acres of farm ponds.

Sport fishing and hunting are the main uses now being made of Kentucky's fish and wildlife resources, but interest in bird-watching, wildlife photography, and other "nonconsumptive" uses is growing rapidly. A national survey of fishing, hunting, and wildlife-associated recreation in 1980 showed that Kentucky had 1,052,600 fishermen and 391,600 hunters who spent $262,851,200 and $121,349,100, respectively, on their sports that year. It also revealed that there were 2,456,100 "nonconsumptive" users, those who merely observed wildlife, in the state. Thus Kentucky's fish and wildlife resources provide substantial economic as well as recreational benefits.

Commerical fishing is a minor industry, but a few fishermen make their living at it. Similarly, commercial trapping for furbearers is not widespread activity, but is followed by a small but persistent number of trappers.

Since enactment of the Endangered Species Act of 1973 several species of Kentucky's wildlife have received special attention. These species are thought to be in danger of extinction and for which special protection has been provided.

The species most often hunted are the cottontail rabbit, both gray and fox squirrel, raccoon, red fox, white-tailed deer, bobwhite quail, wild turkey, ruffed grouse, and mourning dove. Principal game and pan fishes taken by hook-and-line fishing are largemouth bass, smallmouth bass, rock bass, crappie, bluegill, white bass, walleye, muskellunge, and channel catfish. Rainbow trout is stocked in some cold water streams and large reservoirs for put-and-take fishing. The species that are popular with those who are interested in wildlife for purely aesthetic reasons are those that visit the state only occasionally and those that are extrememly shy and seldom seen. Examples of these are the golden eagle, bobcat, and river otter.

The bulk of the catch of commerical fishermen is composed of carp, buffalo, suckers, drum, and various catfishes. Furbearers taken by trappers are the muskrat, raccoon, opossum, red fox, gray fox, mink, skunk, beaver, coyote, and weasel.

In 1985 the list of endangered species in Kentucky contained 20 species. They are the gray bat, Indiana bat, Virginia big-eared bat, cougar, bald eagle, American peregrine falcon, Arctic peregrine falcon, least tern, Bachman's warbler, Kirtland's warbler, ivory-billed woodpecker, red-cocaded woodpecker, Cumberland bean pearly mussel, fat pocketbook pearly mussel, pink mucket pearly mussel, rough pigtoe pearly mussel, tuberculed-blossom pearly mussel, tan riffle shell mussel, yellow-blossom pearly mussel, and Kentucky cave shrimp.

APPENDIX C - SUPPORTING DATA AND REFERENCE INFORMATION

Appendix C Table 1 - Erosion Data by Land Use, Land Capability Class, and Major Land Resource Area - Kentucky

Land Capability Class	Land Use	MLRA 120 Total Area (acres)	MLRA 120 Total Erosion (tons)	MLRA 120 Average Rate/Acre (tons)	MLRA 121 Total Area (acres)	MLRA 121 Total Erosion (tons)	MLRA 121 Average Rate/Acre (tons)
I	Cropland	172,500	448,900	2.6	96,900	170,300	1.8
	Pasture	40,200	13,100	.3	113,800	21,800	.2
	Forest	41,600	2,400	.1	16,700	2,100	.1
	Other	2,700	100	0	1,900	7,100	3.7
	Total I	257,000	464,500	1.8	229,300	201,300	.9
II	Cropland	769,300	4,544,600	5.9	569,600	2,453,000	4.3
	Pasture	258,800	118,700	.5	395,400	145,900	.4
	Forest	148,600	29,300	.2	32,800	8,000	.2
	Other	43,000	268,800	6.3	53,300	9,500	.2
	Total II	1,219,700	4,961,400	4.1	1,051,100	2,616,400	2.5
III	Cropland	404,700	3,121,400	7.7	409,600	2,956,400	7.2
	Pasture	158,100	175,700	1.1	554,000	619,100	1.1
	Forest	225,000	147,700	.7	58,100	63,100	1.1
	Other	38,700	258,700	6.7	17,900	33,600	1.9
	Total III	826,500	3,703,500	4.5	1,039,600	3,672,200	3.5
IV	Cropland	140,600	3,512,600	25.0	130,400	1,504,100	11.5
	Pasture	146,600	275,800	1.9	336,700	947,800	2.8
	Forest	252,300	170,800	.7	87,200	265,200	3.0
	Other	16,400	449,300	27.4	9,700	50,200	5.2
	Total IV	555,900	4,408,500	7.9	564,000	2,767,300	4.9
V	Cropland	0	0	0	700	1,900	2.7
	Pasture	0	0	0	4,900	6,100	1.2
	Forest	6,900	1,300	.2	2,300	100	.0
	Other	0	0	0	1,200	2,200	1.8
	Total V	6,900	1,300	.2	9,100	10,300	1.1
VI	Cropland	63,000	3,405,800	54.1	121,400	835,700	6.9
	Pasture	163,200	408,000	2.5	670,000	2,980,200	4.4
	Forest	369,500	417,000	1.1	413,700	1,460,300	3.5
	Other	21,800	936,700	43.0	8,300	56,600	6.8
	Total VI	617,500	5,167,500	8.4	1,213,400	5,332,800	4.4
VII	Cropland	9,400	144,400	15.4	37,100	320,800	8.6
	Pasture	49,700	197,100	4.0	366,200	1,911,400	5.2
	Forest	421,500	867,700	2.1	504,300	1,957,300	3.9
	Other	123,900	8,649,800	69.8	8,400	44,300	5.3
	Total VII	604,500	9,859,000	16.3	916,000	4,233,800	4.6
VIII	Cropland	0	0	0	0	0	0
	Pasture	0	0	0	0	0	0
	Forest	0	0	0	0	0	0
	Other	1,000	1,300	1.3	4,100	6,500	1.6
	Total VIII	1,000	1,300	1.3	4,100	6,500	1.6
Total	Cropland	1,559,500	15,177,700	9.7	1,365,700	8,242,200	6.0
	Pasture	816,600	1,188,400	1.5	2,441,000	6,632,300	2.7
	Forest	1,465,400	1,636,200	1.1	1,115,100	3,756,100	3.4
	Other	247,500	10,564,700	42.3	104,800	210,000	2.0
Total or Average		4,089,000	28,567,000	7.0	5,026,600	18,840,600	3.7

Appendix C Table 1 - Erosion Data by Land Use, Land Capability Class, and Major Land Resource Area - Kentucky

Land Capability Class	Land Use	MLRA 122 Total Area (acres)	MLRA 122 Total Erosion (tons)	MLRA 122 Average Rate/Acre (tons)	MLRA 123 Total Area (acres)	MLRA 123 Total Erosion (tons)	MLRA 123 Average Rate/Acre (tons)
I	Cropland	143,800	346,900	2.4	104,600	166,100	1.6
	Pasture	58,800	13,300	.2	57,200	8,800	.2
	Forest	30,900	1,300	.0	21,100	1,500	.1
	Other	4,100	1,100	.3	11,300	12,000	1.1
	Total I	237,600	361,700	1.5	194,700	188,500	1.0
II	Cropland	976,500	5,630,900	5.8	154,600	481,200	3.1
	Pasture	384,300	181,100	.5	109,400	37,100	.3
	Forest	104,800	25,800	.2	52,500	2,100	.0
	Other	47,100	217,200	4.6	25,500	193,300	7.6
	Total II	1,512,700	6,055,000	4.0	342,000	714,200	2.1
III	Cropland	501,200	5,222,000	10.4	63,200	210,700	3.3
	Pasture	494,800	616,400	1.2	129,600	155,200	1.2
	Forest	252,300	136,800	.5	126,300	38,000	.3
	Other	23,400	159,200	6.8	12,200	4,000	.3
	Total III	1,271,700	6,134,400	4.8	331,300	407,900	1.2
IV	Cropland	156,500	2,711,200	17.3	29,500	943,400	32.0
	Pasture	339,300	719,000	2.1	85,500	118,300	1.4
	Forest	304,600	298,600	1.0	175,700	138,700	.8
	Other	15,500	109,500	7.1	4,500	12,000	2.7
	Total IV	815,900	3,838,300	4.7	295,200	1,212,400	4.1
V	Cropland	0	0	0	0	0	0
	Pasture	0	0	0	0	0	0
	Forest	0	0	0	0	0	.0
	Other	0	0	0	0	0	0
	Total V	0	0	0	0	0	0
VI	Cropland	59,000	1,043,900	17.7	23,800	989,000	41.6
	Pasture	287,100	1,370,500	4.8	133,000	385,400	2.9
	Forest	450,600	636,300	1.4	313,000	531,500	1.7
	Other	11,500	49,500	4.3	58,500	1,143,500	19.6
	Total VI	808,200	3,100,200	3.8	528,300	3,049,400	5.8
VII	Cropland	3,600	41,500	11.5	21,000	1,089,300	51.9
	Pasture	94,000	678,100	7.2	239,900	3,905,300	16.3
	Forest	836,400	1,995,000	2.4	4,574,000	8,013,600	1.8
	Other	13,400	65,700	4.9	150,400	33,293,400	221.4
	Total VII	947,400	2,780,300	2.9	4,985,300	46,302,100	9.3
VIII	Cropland	0	0	0	0	0	0
	Pasture	0	0	0	0	0	0
	Forest	0	0	0	0	0	0
	Other	6,600	255,500	38.7	1,100	0	0
	Total VIII	6,600	255,500	38.7	1,100	0	0
Total	Cropland	1,840,600	14,995,500	8.1	396,700	3,979,700	9.8
	Pasture	1,658,300	3,578,400	2.2	755,100	4,610,600	6.1
	Forest	1,979,600	3,093,300	1.6	5,262,600	8,725,500	1.7
	Other	121,600	857,700	7.1	263,500	34,658,700	131.5
Total or Average		5,600,100	22,525,400	4.0	6,677,900	51,974,500	7.8

Appendix C Table 1 - Erosion Data by Land Use, Land Capability Class, and Major Land Resource Area - Kentucky

Land Capability Class	Land Use	[illegible] Total Area (acres)	[illegible] Total Erosion (tons)	[illegible] Average Rate/Acre (tons)	[illegible] Total Area (acres)	[illegible] Total Erosion (tons)	[illegible] Average Rate/Acre (tons)
I	Cropland	129,800	491,000	3.8	547,500	1,522,300	2.8
	Pasture	24,100	5,900	.2	294,500	62,900	.2
	Forest	30,700	7,700	.3	141,300	15,100	.1
	Other	2,000	100	.0	22,000	20,400	.9
	Total I	186,600	504,700	2.7	1,105,200	1,720,700	1.6
II	Cropland	302,400	2,681,900	8.9	2,772,400	15,791,600	5.7
	Pasture	68,500	67,100	1.0	1,216,400	549,900	.5
	Forest	75,000	24,900	.3	413,700	90,100	.2
	Other	12,600	23,500	2.0	181,500	712,800	3.9
	Total II	458,500	2,797,400	6.1	4,584,000	17,144,400	3.7
III	Cropland	200,200	2,805,200	14.0	1,579,900	14,315,700	9.1
	Pasture	32,900	45,000	1.4	1,369,400	549,900	.5
	Forest	72,200	12,000	.2	733,900	397,600	.5
	Other	7,700	4,400	.6	99,900	459,900	4.5
	Total III	313,000	2,866,600	9.2	3,792,100	15,723,100	4.2
IV	Cropland	90,500	2,884,700	31.9	547,500	11,556,000	21.1
	Pasture	29,700	54,700	1.9	936,300	2,115,600	2.3
	Forest	48,700	18,100	.4	869,500	491,400	1.0
	Other	6,300	12,900	2.1	52,400	633,900	12.1
	Total IV	174,200	2,970,400	17.1	2,405,200	15,196,900	6.3
V	Cropland	0	0	0	700	1,900	2.7
	Pasture	2,600	0	0	7,500	6,100	1.2
	Forest	0	0	0	9,200	1,400	.7
	Other	0	0	0	1,200	2,200	1.8
	Total V	0	0	0	18,600	11,600	.7
VI	Cropland	34,100	4,465,600	131.0	301,300	10,740,000	35.7
	Pasture	27,000	482,700	17.9	1,280,300	5,626,300	4.4
	Forest	39,900	61,600	1.5	1,586,700	3,106,700	2.0
	Other	1,300	16,700	12.9	101,400	2,203,000	21.7
	Total VI	102,300	5,026,600	49.14	3,269,700	21,676,500	6.6
VII	Cropland	14,700	913,800	62.2	95,800	2,509,800	29.3
	Pasture	25,000	173,700	6.9	774,800	6,866,100	8.9
	Forest	69,000	230,100	3.3	6,405,200	13,063,700	2.0
	Other	10,300	1,529,600	148.5	313,100[1]	52,358,300[2]	167.2
	Total VII	119,000	2,847,200	23.9	7,578,900	74,797,900	9.9
VIII	Cropland	0	0	0	0	0	0
	Pasture	0	0	0	0	0	0
	Forest	0	0	0	0	0	0
	Other	500	1,000	2.0	13,300	264,300	19.9
	Total VIII	500	1,000	2.0	13,300	264,300	19.9
Total	Cropland	771,700	14,242,200	18.5	5,934,200	56,537,300	9.5
	Pasture	208,800	829,100	4.0	5,379,800	16,838,900	2.9
	Forest	335,500	354,400	1.1	10,158,200	17,566,000	1.7
	Other	40,700	1,588,200	39.0	784,300[1]	56,654,900[2]	72.2
Total or Average		1,356,700	17,013,900	13.0	22,757,000	147,596,900	6.5

Footnotes: for Appendix C Table 1

1/ Includes 6,700 acres of other land in Land Capability Class VII that is not distributed by MRLA.

2/ Includes 8,775,500 tons of erosion on other land accredited to Land Capability Class VII but not distributed by MRLA

Source: Compiled from data in the 1982 National Resource Inventory

Appendix C Table 2 - Conservation Treatment Needs on Cropland in 1982 by Major Land Resource Area [1]/

Kentucky

MLRA	Adequately Protected	Treatment Needed				Total
		Erosion Control	Drainage	Irrigation Management	Subtotal	
	1,000 acres					
120	683.0	615.6	260.9	0.0	876.5	1,559.5
121	841.0	503.4	18.9	2.4	524.7	1,365.7
122	796.6	1,014.6	29.4	0.0	1,044.0	1,840.6
125	271.7	102.7	22.3	0.0	125.0	396.7
134	262.4	476.5	32.8	0.0	509.3	771.7
TOTAL	2,854.7	2,712.8	364.3	2.4	3,079.5	5,934.2

[1]/ Includes irrigated and nonirrigated cropland acreage.

Source: 1982 National Resource Inventory

Appendix C Table 3 - Conservation Treatment Needs on Pastureland in 1982 by Major Land Resource Area

Kentucky

MLRA	Adequately Protected	Treatment Not Feasible	Subtotal	Treatment Needed							Total
				Erosion Control	Drainage	Irrigation Management	Protection	Improvement	Reestab-lishment	Subtotal	
	1,000 acres										
120	338.8	2.2	341.0	67.3	18.8	0.0	37.2	244.2	108.1	475.6	816.6
121	989.2	17.4	1006.6	58.1	6.1	0.0	124.0	1,021.5	224.7	1,434.4	2,441.0
122	792.2	5.1	797.3	56.7	9.5	1.1	46.3	561.5	185.9	861.0	1,658.3
125	232.5	9.9	242.4	46.3	10.2	0.0	24.2	333.8	98.2	512.7	755.1
134	85.4	1.2	866.6	16.0	0.0	0.0	14.4	57.5	34.3	122.2	208.8
TOTAL	2,438.1	35.8	2473.9	244.4	44.6	2.2	246.1	2,218.5	651.2	3,405.9	5,879.8

Source: 1982 National Resource Inventory

Appendix C Table 4 - Conservation Treatment Needs on Farmsteads, Other Land in Farms, Mines, Quarries, Pits, and Other Rural Lands in 1982 by Major Land Resource Area

Kentucky

MLRA	Adequately Protected	Treatment Not Feasible	Subtotal	Treatment Needed				Total
				Erosion Control	Drainage	Irrigation Management	Subtotal	
	1,000 acres							
120	65.9	124.5	190.4	52.7	4.4	0.0	57.1	247.5
121	81.3	9.2	90.5	14.3	0.0	0.0	14.3	104.8
122	83.1	11.2	94.3	27.3	0.0	0.0	27.3	121.6
125	55.8	170.5	226.3	43.9	0.0	0.0	43.9	270.2
134	25.4	8.8	34.2	5.2	1.3	0.0	6.5	40.7
TOTAL	311.5	324.2	635.7	143.4	5.7	0.0	149.1	784.8

Source: 1982 National Resource Inventory

Appendix C Table 5 - Prime Farmland in 1982 by Major Land Resource Area

Kentucky

MLRA	Cropland	Pastureland	Forest Land	Minor Land Cover/Uses	Total
			acres		
120	1,146,400	307,800	239,400	45,500	1,739,100
121	672,200	502,100	47,700	39,800	1,261,800
122	1,160,900	441,200	142,600	47,400	1,792,100
125	254,900	152,900	68,100	27,500	503,400
134	522,600	101,600	118,000	12,100	754,300
TOTAL	3,757,000	1,505,600	615,800	172,300	6,050,700

Source: 1982 National Resource Inventory

Appendix C Table 6 - Prime Farmland by County

Kentucky

County	Prime Farmland Area 1/	Proportion of Total County	Additional Available If Drained and/or Protected from Flooding	Lost to Urban Use from 1970 - 1980
	(acres)	(percent)	(acres)	(acres)
Adair	56,220	23.7	400	200
Allen	62,931	27.0	13,000	100
Anderson	13,039	10.0	0	250
Ballard	78,685	47.4	18,630	200
Barren	113,974	38.0	7,261	520
Bath	43,818	23.8	4,800	25
Bell	2,730	1.2	2,000	110
Boone	29,963	18.8	4,350	2,500
Bourbon	89,190	46.4	0	2,445
Boyd	9,160	8.9	1,200	2,000
Boyle	21,485	18.3	9,795	900
Bracken	9,539	7.3	2,725	75
Breathitt	9,997	3.2	471	191
Breckinridge	87,029	24.1	700	400
Bullittt	47,699	24.9	0	7,000
Butler	71,639	25.3	9,835	100
Caldwell	93,340	40.8	5,222	100
Calloway	89,370	36.4	26,000	1,000
Campbell	7,596	7.9	4,240	800
Carlisle	51,523	41.2	23,000	20
Carroll	8,495	10.2	8,290	300
Carter	11,314	4.5	7,000	550
Casey	50,025	17.9	17,000	0
Christian	205,350	44.2	22,530	5,000
Clark	50,177	30.2	0	1,600
Clay	12,132	4.0	8,289	688
Clinton	20,068	16.5	300	10
Crittenden	77,681	33.3	16,824	100
Cumberland	26,136	13.2	1,200	10
Daviess	168,070	56.8	19,000	3,000
Edmonson	38,575	19.8	1,500	200
Elliott	9,886	6.4	1,100	50
Estill	22,503	13.5	1,071	62
Fayette	49,045	27.3	9,005	16,250
Fleming	43,751	19.5	3,900	140
Floyd	2,534	1.0	5,000	250
Franklin	25,217	18.6	2,500	1,800
Fulton	91,260	70.2	2,600	25
Gallatin	7,560	11.9	4,000	200
Garrard	21,709	14.3	0	220
Grant	16,485	10.3	465	200
Graves	197,624	55.1	6,000	1,000
Grayson	96,340	30.3	11,700	1,000
Green	39,654	21.9	7,560	450
Greenup	27,350	12.2	8,500	900

Appendix C - Table 6 - Prime Farmland by County
Kentucky

County	Prime Farmland Area	Proportion of Total County	Additional Available If Drained and/or Protected from Flooding	Lost to Urban Use from 1970 - 1980
	(acres)	(percent)	(acres)	(acres)
Hancock	42,500	35.5	1,660	50
Hardin	135,985	34.5	8,000	2,000
Harlan	2,173	0.7	4,619	90
Harrison	39,770	20.2	1,500	100
Hart	50,879	18.7	450	1,800
Henderson	186,134	67.1	18,500	1,900
Henry	54,539	29.5	900	1,350
Hickman	101,669	64.5	2,000	200
Hopkins	157,450	44.5	15,000	1,125
Jackson	12,378	5.7	770	700
Jefferson	46,590	19.4	15,131	12,000
Jessamine	33,995	30.0	7,960	2,100
Johnson	1,783	0.1	5,033	435
Kenton	11,086	10.5	3,250	400
Knott	7,312	3.2	0	0
Knox	25,015	10.5	7,600	115
Larue	69,141	41.5	1,921	98
Laurel	38,220	13.4	9,013	481
Lawrence	11,296	4.2	1,982	125
Lee	4,365	3.2	582	40
Leslie	3,050	1.2	0	0
Letcher	3,697	1.7	50	300
Lewis	32,372	10.4	11,000	3,000
Lincoln	62,135	28.5	925	525
Livingston	54,796	27.5	11,200	256
Logan	190,814	53.0	0	620
Lyon	32,990	23.1	3,650	400
McCracken	73,636	46.1	5,664	1,400
McCreary	7,934	3.0	547	0
McLean	114,670	69.7	2,500	20
Madison	57,470	20.1	9,630	2,500
Magoffin	5,644	3.0	6,165	150
Marion<	60,705	27.7	5,950	613
Marshall<	73,933	38.2	10,785	2,800
Martin	1,232	0.8	4,037	70
Mason	34,641	22.8	620	400
Meade	43,913	22.5	200	100
Menifee	7,707	5.7	730	10
Mercer	29,225	17.9	8,290	700
Metcalfe	44,187	23.3	12,658	100
Monroe	30,920	14.5	8,500	300
Montgomery	38,680	29.7	5,550	125
Morgan	14,027	5.9	5,250	50
Muhlenberg	89,670	29.2	32,250	750
Nelson	77,855	27.8	17,000	300
Nicholas	18,210	13.9	0	0
Ohio	133,382	35.0	14,570	21

Appendix C - Table 6 - Prime Farmland by County
Kentucky

County	Prime Farmland Area	Proportion of Total County	Additional Available If Drained and/or Protected from Flooding	Lost to Urban Use from 1970 - 1980
	(acres)	(percent)	(acres)	(acres)
Oldham	38,020	32.4	1,590	6,056
Owen	20,180	9.0	760	100
Owsley	6,948	5.5	497	36
Pendleton	11,845	6.6	2,300	150
Perry	4,370	2.0	0	0
Pike	6,841	1.4	2,800	2,000
Powell	10,442	9.4	4,469	245
Pulaski	61,695	14.8	14,675	3,000
Robertson	7,064	11.0	0	0
Rockcastle	19,950	10.0	2,980	1,500
Rowan	18,910	10.2	4,900	700
Russdell	34,640	22.7	2,500	150
Scott	60,529	33.3	2,214	3,930
Shelby	80,355	32.8	1,475	2,645
Simpson	83,810	55.0	6,000	140
Spencer	21,829	17.7	0	200
Taylor	44,626	25.2	6,159	992
Todd	128,402	53.4	0	12
Trigg	87,760	32.0	1,500	1,200
Trimble	23,130	25.0	1,000	950
Union	143,370	65.8	3,000	30
Warren	123,719	35.4	5,143	3,500
Washington	31,943	16.3	4,325	465
Wayne	32,276	11.5	645	142
Webster	124,689	57.5	4,700	100
Whitley	40,516	13.8	8,000	100
Wolfe	8,437	5.8	2,457	378
Woodford	54,432	44.1	1,860	900
TOTAL	6,003,046		668,504	123,181

1/ Estimates based on soil survey or Conservation Needs Inventory Data with local adjustments for urban growth, and for soil having wetness and/or flooding limitations too severe for classification as prime farmland.

Appendix C - Table 7 - Estimated Net Returns by Soil Resource Group and by Tillage System for MLRA 120

Kentucky

Soil Resource Group	Tillage System	T Value	Erosion Range	Net Returns: Erosion Below T — Number of Options	Erosion Below T — Range Low	Erosion Below T — Range High	Net Returns: Erosion Above T — Number of Options	Erosion Above T — Range Low	Erosion Above T — Range High
		(tons)	(t/a/y)		(dollars)			(dollars)	
1	Conventional	5	4.1 - 5.5	20	154	158	2	100	103
	Conservation	5	1.4 - 4.8	4	94	154	-	-	-
	No Till	5	0.4 - 2.3	6	84	147	-	-	-
2	Conventional	5	4.5 - 6.0	14	128	132	8	86	131
	Conservation	5	1.5 - 5.2	3	127	128	1	79	-
	No Till	5	0.3 - 2.7	6	48	104	-	-	-
3	Conventional	5	2.9 - 3.9	22	64	113	-	-	-
	Conservation	5	1.0 - 3.4	4	58	109	-	-	-
	No Till	5	0.3 - 2.7	6	48	104	-	-	-
4	Conventional	5	1.6 - 20.7	0	66	138	-	86	143
	Conservation	5	0.5 - 18.2	9	60	138	5	80	139
	No Till	5	0.1 - 8.6	21	75	166	1	96	-
5	Conventional	3	1.5 - 20.5	22	51	91	62	71	112
	Conservation	3	0.5 - 17.9	9	45	106	5	65	108
	No Till	3	0.1 - 8.5	20	59	138	2	79	80
6	Conventional	4		-	-	-	84	49	108
	Conservation	4	1.4 - 39.7	5	43	99	9	43	104
	No Till	4	0.4 - 18.8	20	57	134	2	77	78

Appendix C - Table 7 - Estimated Net Returns by Soil Resource Group and by Tillage System for MLRA 120

Kentucky

Soil Resource Group	Tillage System	T Value	Erosion Range	Net Returns: Erosion Below T — Number of Options	Erosion Below T — Range Low	Erosion Below T — Range High	Erosion Above T — Number of Options	Erosion Above T — Range Low	Erosion Above T — Range High
		(tons)	(t/a/y)		(dollars)			(dollars)	
7	Conventional	3	4.7 - 53.4	-	-	-	84	31	78
	Conservation	3	1.7 - 46.2	3	53	54	11	25	75
	No Till	3	0.4 - 36.0	12	46	92	10	33	94
8	Conventional	3	1.7 - 22.5	22	-71	-32	62	-55	-11
	Conservation	3	0.6 - 19.5	6	-71	-32	8	-52	-11
	No Till	3	0.1 - 15.2	16	-94	-22	6	-54	-32
9g	Conventional	3	4.9 - 54.2	-	-	-	84	-116	-37
	Conservation	3	1.8 - 46.2	3	-116	-58	11	-100	-37
	No Till	3	1.0 - 36.0	9	-138	-68	13	-98	-47
9h	Conventional	3	11.2 - 124.8	-	-	-	84	-131	-60
	Conservation	3	4.1 - 106.4	-	-	-	14	-131	-67
	No Till	3	2.2 - 82.9	5	-171	-98	17	-135	-76
10	Conventional		0.6 - 7.2	62	-11	20	22	10	21
	Conservation	5	0.2 - 6.1	13	-17	18	1	4	-
	No Till		0.1 - 4.8	22	-36	6	-	-	-
11	Conventional		41.1 - 124.3	-	-	-	62	-40	-10
	Conservation	4	11.8 - 34.3	-	-	-	10	-41	-12
	No Till		6.3 - 21.4	-	-	-	16	-47	-24

Appendix C - Table 7 - Estimated Net Returns by Soil Resource Group and by Tillage System for MLRA 120

Kentucky

Soil Resource Group	Tillage System	T Value	Erosion Range	Net Returns: Erosion Below T: Number of Options	Net Returns: Erosion Below T: Range Low	Net Returns: Erosion Below T: Range High	Net Returns: Erosion Above T: Number of Options	Net Returns: Erosion Above T: Range Low	Net Returns: Erosion Above T: Range High
		(tons)	(t/a/y)		(dollars)			(dollars)	
14	Conventional		4.0 - 5.3	60	32	119	6	12	85
	Conservation	5	1.4 - 4.7	12	6	116	-	-	-
	No Till		0.4 - 3.6	18	-31	80	-	-	-
15	Conventional		4.6 - 6.2	-	-	-	66	-19	77
	Conservation	4	1.6 - 5.4	9	-20	73	3	-11	59
	No Till		0.4 - 4.2	15	-47	40	3	-51	20
16	Conventional		4.7 - 6.1	-	-	-	44	-61	-6
	Conservation	3	1.7 - 5.2	6	-62	-8	2	-41	-31
	No Till		0.9 - 4.1	10	-87	-31	2	-70	-62

Source: Compiled from Kentucky Special Resources Study data and reference reports.

Appendix C - Table 8 - Estimated Net Returns by Soil Resource Group and by Tillage System for MLRA 121 and Eastern MLRA 122

Kentucky

Soil Resource Group	Tillage System	T Value	Erosion Range	Net Returns: Erosion Below T — Number of Options	Erosion Below T — Range Low	Erosion Below T — Range High	Erosion Above T — Number of Options	Erosion Above T — Range Low	Erosion Above T — Range High
		(tons)	(t/a/y)		(dollars)			(dollars)	
1	Conventional	5	0.7 - 4.7	6	35	128	-	-	-
	Conservation		0.5 - 4.1	6	38	130	-	-	-
	No Till		0.2 - 2.0	6	37	132	-	-	-
2	Conventional	4	0.7 - 4.8	4	39	103	2	22	52
	Conservation		0.5 - 4.1	5	45	105	1	25	-
	No Till		0.2 - 2.0	6	24	107	-	-	-
3	Conventional	5	0.7 - 4.5	6	2	75	-	-	-
	Conservation		0.7 - 3.9	6	5	77	-	-	-
	No Till		0.2 - 3.0	6	4	79	-	-	-
4	Conventional	5	0.2 - 15.0	14	15	104	8	20	54
	Conservation		0.2 - 13.1	20	3	106	2	-	24
	No Till		0.1 - 6.2	21	-1	110	1		45
5	Conventional	3	0.2 - 15.8	11	-15	66	11	5	30
	Conservation		0.2 - 13.6	17	-11	67	5	9	36
	No Till		0.1 - 6.5	20	10	72	2	30	31
6	Conventional	3	0.7 - 40.7	4	9	77	18	-36	24
	Conservation		0.5 - 35.2	8	-3	80	14	-14	81
	No Till		0.2 - 16.8	20	4	86	2	27	28

Appendix C - Table 8 - Estimated Net Returns by Soil Resource Group and by Tillage System for MLRA 121 and Eastern MLRA 122

Kentucky

Soil Resource Group	Tillage System	T Value	Erosion Range	Net Returns: Erosion Below T — Number of Options	Erosion Below T — Range Low	Erosion Below T — Range High	Erosion Above T — Number of Options	Erosion Above T — Range Low	Erosion Above T — Range High
		(tons)	(t/a/y)		(dollars)			(dollars)	
7	Conventional		0.7 - 42.3	4	-13	21	18	-36	24
	Conservation	3	0.7 - 36.3	7	-22	23	15	-32	26
	No Till		0.2 - 28.0	19	-11	30	3	-13	8
8	Conventional		0.3 - 17.2	11	-173	-56	11	-158	-55
	Conservation	3	0.3 - 14.7	15	-161	-51	7	-140	-50
	No Till		0.1 - 11.4	20	-155	-42	2	-86	-85
9g	Conventional		0.7 - 39.6	4	-112	-76	18	-230	-74
	Conservation	3	0.7 - 33.1	7	-215	-72	15	-199	-70
	No Till		0.3 - 25.6	12	-206	-61	10	-187	-60
9h	Conventional		1.0 - 37.0	2	-123	-104	16	-265	-102
	Conservation	3	0.9 - 31.0	5	-249	-100	13	-233	-97
	No Till		0.9 - 24.0	9	-241	-89	9	-222	-88
9i	Conventional		2.0 - 106.1	2	-112	-95	20	-230	-74
	Conservation	3	1.8 - 88.7	2	-109	-90	20	-215	-69
	No Till		0.8 - 68.6	7	-206	-62	15	-190	-60
9j	Conventional		3.1 - 113.6	-	-	-	18	-265	-102
	Conservation	3	2.8 - 95.0	1	-	-118	17	-249	-97
	No Till		1.2 - 73.5	4	-241	-109	14	-225	-88

Appendix C - Table 8 - Estimated Net Returns by Soil Resource Group and by Tillage System for MLRA 121 and Eastern MLRA 122

Kentucky

Soil Resource Group	Tillage System	T Value	Erosion Range	Net Returns: Erosion Below T — Number of Options	Erosion Below T — Range Low	Erosion Below T — Range High	Erosion Above T — Number of Options	Erosion Above T — Range Low	Erosion Above T — Range High
		(tons)	(t/a/y)		(dollars)			(dollars)	
10	Conventional		0.2 - 7.1	14	-86	-31	4	-65	-47
	Conservation	5	0.2 - 5.9	17	-79	-28	1	-	-52
	No Till		0.1 - 4.6	18	-81	-24	-	-	-
11	Conventional		11.1 - 122.6	-	-	-	13	-129	-37
	Conservation	3	10.1 - 102.6	-	-	-	13	-119	-33
	No Till		0.3 - 25.6	-	-	-	13	-117	-27
14	Conventional		1.3 - 6.1	9	-50	33	6	-54	37
	Conservation	5	0.9 - 5.2	12	-44	44	3	-50	20
	No Till		0.3 - 4.0	15	-76	37	-	-	-
15	Conventional		4.5 - 6.1	-	-	-	12	-106	15
	Conservation	4	1.5 - 5.2	9	-96	21	3	-64	12
	No Till		0.4 - 4.0	9	-107	5	3	-88	-18
16	Conventional		4.6 - 6.2	-	-	-	8	-150	-59
	Conservation	3	1.6 - 5.2	6	-140	-53	2	-102	-75
	No Till		0.9 - 4.0	6	-151	-63	2	-109	-104

Source: Compiled from Kentucky Special Resources Study data and reference reports.

Appendix C - Table 9 - Estimated Net Returns by Soil Resource Group and by Tillage System for Western MLRA 122

Kentucky

Soil Resource Group	Tillage System	T Value	Erosion Range	Net Returns: Erosion Below T: Number of Options	Net Returns: Erosion Below T: Range Low	Net Returns: Erosion Below T: Range High	Net Returns: Erosion Above T: Number of Options	Net Returns: Erosion Above T: Range Low	Net Returns: Erosion Above T: Range High
		(tons)	(t/a/y)		(dollars)			(dollars)	
1	Conventional		4.1 - 5.5	3	76	130	1	61	-
	Conservation	5	1.4 - 4.8	4	74	146	-	-	-
	No Till		0.4 - 2.3	5	65	104	-	-	-
2	Conventional		3.6 - 4.8	4	61	100	-	22	52
	Conservation	5	1.2 - 4.2	4	51	116	-	25	-
	No Till		0.3 - 2.0	5	48	74	-	-	-
3	Conventional		2.9 - 3.9	4	27	60	-	-	-
	Conservation	5	1.0 - 3.4	4	40	75	-	-	-
	No Till		0.3 - 2.7	5	31	53	-	-	-
4	Conventional		1.2 - 15.6	6	26	91	8	46	112
	Conservation	5	0.4 - 13.7	12	40	128	2	60	61
	No Till		0.1 - 6.5	17	53	107	1	-	74
5	Conventional		1.4 - 18.3	6	10	50	8	29	71
	Conservation	4	0.5 - 15.9	9	25	86	5	45	87
	No Till		0.1 - 7.6	17	38	82	1	-	60
6	Conventional		3.5 - 39.4	3	4	40	11	9	61
	Conservation	4	1.2 - 34.4	5	28	60	9	23	78
	No Till		0.3 - 16.3	16	29	77	2	56	57

Appendix C - Table 9 - Estimated Net Returns by Soil Resource Group and by Tillage System for Western MLRA 122

Kentucky

Soil Resource Group	Tillage System	T Value	Erosion Range	Net Returns: Erosion Below T — Number of Options	Erosion Below T — Range Low	Erosion Below T — Range High	Erosion Above T — Number of Options	Erosion Above T — Range Low	Erosion Above T — Range High
		(tons)	(t/a/y)		(dollars)			(dollars)	
7	Conventional		3.5 - 39.7	3	-25	17	11	-9	38
	Conservation	4	1.2 - 34.4	5	28	60	9	5	55
	No Till		0.3 - 26.8	14	2	41	4	27	36
8	Conventional		1.3 - 18.0	4	-169	-88	10	-153	-67
	Conservation	3	0.5 - 15.5	8	-135	-66	6	-114	-45
	No Till		0.1 - 12.1	15	-130	-72	3	-109	-53
9g	Conventional		3.0 - 40.3	-	-	-	14	-224	-99
	Conservation	3	1.3 - 34.4	3	-186	-96	11	-170	-75
	No Till		0.7 - 26.8	7	-178	-119	11	-159	-79
9h	Conventional		3.6 - 40.3	-	-	-	14	-260	-122
	Conservation	3	1.3 - 34.4	3	-221	-126	11	-205	-99
	No Till		0.7 - 26.8	7	-212	-149	11	-193	-99
9i	Conventional		9.1 - 101.2	-	-	-	14	-224	-99
	Conservation	4	3.3 - 86.2	2	-186	-141	12	-170	-75
	No Till		1.8 - 67.2	4	-178	-119	14	-162	-79
9j	Conventional		9.7 - 108.0	-	-	-	14	-260	-122
	Conservation	3	3.5 - 92.0	-	-	-	14	-221	-99
	No Till		1.9 - 71.7	4	-212	-149	14	-196	-99

Appendix C - Table 9 - Estimated Net Returns by Soil Resource Group and by Tillage System for Western MLRA 122

Kentucky

Soil Resource Group	Tillage System	T Value	Erosion Range	Net Returns: Erosion Below T: Number of Options	Net Returns: Erosion Below T: Range Low	Net Returns: Erosion Below T: Range High	Net Returns: Erosion Above T: Number of Options	Net Returns: Erosion Above T: Range Low	Net Returns: Erosion Above T: Range High
		(tons)	(t/a/y)		(dollars)			(dollars)	
10	Conventional		0.6 - 7.2	10	-87	-23	4	-66	-22
	Conservation	5	0.2 - 6.1	13	-62	-5	1	-	-16
	No Till		0.1 - 4.8	18	-66	-24	-	-	-
11	Conventional		35.4 - 108.0	-	-	-	10	-127	-58
	Conservation	3	11.7 - 92.0	-	-	-	10	-98	-40
	No Till		6.9 - 71.7	-	-	-	13	-97	-47
14	Conventional		4.6 - 6.2	-	-	-	12	-31	69
	Conservation	4	1.6 - 5.4	9	-8	84	3	-14	56
	No Till		0.4 - 4.2	12	-48	35	3	-49	21
15	Conventional		4.6 - 6.2	-	-	-	12	-104	21
	Conservation	3	1.6 - 5.4	9	-76	39	3	-33	37
	No Till		0.4 - 4.2	12	-95	-6	3	-70	-
16	Conventional		4.9 - 6.3	-	-	-	8	-149	-52
	Conservation	3	1.7 - 5.4	6	-121	-34	2	-64	-53
	No Till		0.9 - 4.2	8	-139	-79	2	-89	-82

Source: Compiled from Kentucky Special Resources Study data and reference reports.

Appendix C - Table 10 - Estimated Net Returns by Soil Resource Group and by Tillage System for MLRA 134

Kentucky

Soil Resource Group	Tillage System	T Value	Erosion Range	Net Returns: Erosion Below T — Number of Options	Erosion Below T — Range Low	Erosion Below T — Range High	Net Returns: Erosion Above T — Number of Options	Erosion Above T — Range Low	Erosion Above T — Range High
		(tons)	(t/a/y)		(dollars)			(dollars)	
1a	Conventional		3.9 - 5.2	20	151	155	2	99	101
	Conservation	5	1.3 - 4.6	4	93	151	-	-	-
	No Till		0.3 - 2.2	6	83	145	-	-	-
1b	Conventional		3.9 - 5.2	20	154	158	2	100	103
	Conservation	5	1.3 - 4.6	4	94	154	-	-	-
	No Till		0.4 - 2.2	6	84	147	-	-	-
1c	Conventional		3.9 - 5.2	20	137	143	2	90	92
	Conservation	5	1.3 - 4.6	4	84	139	-	-	-
	No Till		0.3 - 2.2	6	74	130	-	-	-
1d	Conventional		3.9 - 5.2	20	146	150	2	95	98
	Conservation	5	1.3 - 4.6	4	89	146	-	-	-
	No Till		0.4 - 2.2	6	79	139	-	-	-
2a	Conventional		3.9 - 5.3	20	126	130	2	84	86
	Conservation	5	1.3 - 4.6	4	78	126	-	-	-
	No Till		0.3 - 2.2	6	68	119	-	-	-
2b	Conventional		3.9 - 5.3	20	128	132	2	86	88
	Conservation	5	1.3 - 4.6	4	79	128	-	-	-
	No Till		0.3 - 2.2	6	70	121	-	-	-

Appendix C - Table 10 - Estimated Net Returns by Soil Resource Group and by Tillage System for MLRA 134

Kentucky

Soil Resource Group	Tillage System	T Value	Erosion Range	Net Returns: Erosion Below T — Number of Options	Erosion Below T — Range Low	Erosion Below T — Range High	Erosion Above T — Number of Options	Erosion Above T — Range Low	Erosion Above T — Range High
		(tons)	(t/a/y)		(dollars)			(dollars)	
2c	Conventional		3.9 - 5.3	20	107	114	2	73	76
	Conservation	5	1.3 - 4.6	4	67	111	-	-	-
	No Till		0.3 - 2.2	6	58	101	-	-	-
2d	Conventional		3.9 - 5.3	20	114	121	2	78	80
	Conservation	5	1.3 - 4.6	4	71	118	-	-	-
	No Till		0.3 - 2.2	6	62	108	-	-	-
3a	Conventional		3.8 - 5.1	20	90	111	2	62	64
	Conservation	5	1.3 - 4.4	4	56	107	-	-	-
	No Till		0.4 - 3.4	6	46	101	-	-	-
3b	Conventional		3.8 - 5.1	20	92	113	2	64	66
	Conservation	5	1.3 - 4.4	4	58	109	-	-	-
	No Till		0.4 - 3.4	6	48	104	-	-	-
3c	Conventional		3.8 - 5.1	20	72	86	2	48	50
	Conservation	5	1.3 - 4.4	4	42	82	-	-	-
	No Till		0.4 - 3.4	6	32	77	-	-	-
3d	Conventional		3.8 - 5.1	20	78	94	2	53	55
	Conservation	5	1.3 - 4.4	4	46	90	-	-	-
	No Till		0.4 - 3.4	6	37	85	-	-	-

Appendix C - Table 10 - Estimated Net Returns by Soil Resource Group and by Tillage System for MLRA 134

Kentucky

Soil Resource Group	Tillage System	T Value	Erosion Range	Net Returns: Erosion Below T — Number of Options	Erosion Below T — Range Low	Erosion Below T — Range High	Net Returns: Erosion Above T — Number of Options	Erosion Above T — Range Low	Erosion Above T — Range High
		(tons)	(t/a/y)		(dollars)			(dollars)	
4a	Conventional		2.3 - 31.1	22	65	120	62	85	141
	Conservation	5	0.8 - 27.3	9	59	136	5	79	137
	No Till		0.2 - 13.0	20	73	158	2	93	94
4b	Conventional		2.3 - 31.1	22	66	122	62	86	143
	Conservation	5	0.8 - 27.3	94	59	136	5	79	137
	No Till		0.2 - 13.0	20	75	161	2	95	96
4c	Conventional		2.3 - 31.1	22	56	107	62	76	128
	Conservation	5	0.8 - 27.3	9	50	124	5	70	125
	No Till		0.2 - 13.0	20	63	141	2	83	84
4d	Conventional		2.3 - 31.1	22	59	111	62	79	132
	Conservation	5	0.8 - 27.3	9	53	128	5	73	129
	No Till		0.2 - 13.0	20	67	146	2	87	88
5a	Conventional		2.3 - 31.1	20	81	88	64	49	109
	Conservation	3	0.8 - 27.3	6	43	101	8	63	105
	No Till		0.2 - 12.9	20	58	131	2	78	79
5b	Conventional		2.3 - 31.1	20	84	91	64	51	112
	Conservation	3	0.8 - 27.3	6	45	103	8	65	108
	No Till		0.2 - 12.9	20	59	134	2	79	80

Appendix C - Table 10 - Estimated Net Returns by Soil Resource Group and by Tillage System for MLRA 134

Kentucky

Soil Resource Group	Tillage System	T Value	Erosion Range	Net Returns: Erosion Below T — Number of Options	Erosion Below T — Range Low	Erosion Below T — Range High	Net Returns: Erosion Above T — Number of Options	Erosion Above T — Range Low	Erosion Above T — Range High
		(tons)	(t/a/y)		(dollars)			(dollars)	
5c	Conventional		2.3 - 31.3	20	65	70	64	37	91
	Conservation	3	0.8 - 27.3	6	31	83	8	51	88
	No Till		0.2 - 12.9	20	46	111	2	66	67
5d	Conventional		2.3 - 31.3	20	73	76	64	43	97
	Conservation	3	0.8 - 27.3	6	36	90	8	56	95
	No Till		0.2 - 12.9	20	51	119	2	71	72
6a	Conventional		7.0 - 77.7	-	-	-	84	47	105
	Conservation	5	2.3 - 67.8	3	74	81	11	41	102
	No Till		0.6 - 32.1	15	56	126	7	76	128
6b	Conventional		7.0 - 77.7	-	-	-	84	49	108
	Conservation	5	2.3 - 67.8	3	76	83	11	43	104
	No Till		0.6 - 32.1	15	57	128	7	77	130
6c	Conventional		7.0 - 77.7	-	-	-	84	33	80
	Conservation	5	2.3 - 67.8	3	55	56	11	26	77
	No Till		0.6 - 38.1	15	41	100	7	61	102
6d	Conventional		7.0 - 77.7	-	-	-	89	40	90
	Conservation	5	2.3 - 67.8	3	64	65	11	33	86
	No Till		0.6 - 32.1	15	48	111	7	68	113

Appendix C - Table 10 - Estimated Net Returns by Soil Resource Group and by Tillage System for MLRA 134

Kentucky

Soil Resource Group	Tillage System	T Value	Erosion Range	Net Returns: Erosion Below T — Number of Options	Erosion Below T — Range Low	Erosion Below T — Range High	Erosion Above T — Number of Options	Erosion Above T — Range Low	Erosion Above T — Range High
		(tons)	(t/a/y)		(dollars)			(dollars)	
7a	Conventional		4.6 - 62.5	-	-	-	84	31	78
	Conservation	3	1.6 - 54.0	3	53	54	11	25	75
	No Till		0.4 - 42.1	12	45	87	10	33	89
7b	Conventional		4.6 - 62.5	-	-	-	84	31	78
	Conservation	3	1.6 - 54.0	3	53	54	11	25	75
	No Till		0.4 - 42.1	12	45	87	10	33	89
7c	Conventional		4.6 - 62.5	-	-	-	84	9	50
	Conservation	3	1.6 - 54.0	3	17	27	11	3	48
	No Till		0.4 - 42.1	12	9	51	10	10	53
7d	Conventional		4.6 - 62.5	-	-	-	84	21	65
	Conservation	3	1.6 - 54.0	3	34	41	11	14	62
	No Till		0.4 - 42.1	12	27	69	10	22	71
7e	Conventional		4.6 - 62.5	-	-	-	84	-48	-2
	Conservation	3	1.6 - 54.0	3	-49	-24	11	-36	-3
	No Till		0.4 - 42.1	12	-59	-10	10	-32	-8
8c	Conventional		2.4 - 32.9	20	-18	8	64	-8	29
	Conservation	3	0.9 - 28.5	6	-19	12	8	0	27
	No Till		0.2 - 22.2	16	-43	15	6	-4	8

Appendix C - Table 10 - Estimated Net Returns by Soil Resource Group and by Tillage System for MLRA 134

Kentucky

Soil Resource Group	Tillage System	T Value	Erosion Range	Net Returns: Erosion Below T — Number of Options	Erosion Below T — Range Low	Erosion Below T — Range High	Net Returns: Erosion Above T — Number of Options	Erosion Above T — Range Low	Erosion Above T — Range High
		(tons)	(t/a/y)		(dollars)			(dollars)	
8d	Conventional		2.4 - 32.9	20	-79	-39	64	-2	37
	Conservation	3	0.9 - 28.5	63	-79	-39	8	-60	-18
	No Till		0.2 - 22.2	16	-33	23	6	2	17
8e	Conventional		2.4 - 32.9	20	-79	-39	64	-63	-18
	Conservation	3	0.9 - 28.5	6	-79	54	8	-60	-18
	No Till		0.2 - 22.2	16	-102	87	6	-62	-37
9c	Conventional		7.0 - 77.9	-	-	-	84	-63	4
	Conservation	3	2.5 - 66.4	23	-63	-40	12	-47	3
	No Till		1.4 - 51.7	4	-86	-29	18	-52	-8
9d	Conventional		7.0 - 77.9	-	-	-	84	-50	15
	Conservation	3	7.5 - 66.4	2	-126	-96	12	-110	-46
	No Till		1.4 - 51.7	4	-74	-18	18	-41	3
9e	Conventional		7.0 - 77.9	-	-	-	84	-126	-46
	Conservation	3	2.5 - 66.4	2	-126	-96	12	-110	-46
	No Till		1.4 - 51.7	4	-148	-77	18	-111	-56
10a	Conventional		1.1 - 13.9	40	-14	10	44	5	18
	Conservation	5	0.4 - 11.9	11	-19	14	3	1	15
	No Till		0.2 - 9.3	21	-41	2	1		-8

Appendix C - Table 10 - Estimated Net Returns by Soil Resource Group and by Tillage System for MLRA 134

Kentucky

Soil Resource Group	Tillage System	T Value	Erosion Range	Net Returns: Erosion Below T — Number of Options	Erosion Below T — Range Low	Erosion Below T — Range High	Net Returns: Erosion Above T — Number of Options	Erosion Above T — Range Low	Erosion Above T — Range High
		(tons)	(t/a/y)		(dollars)			(dollars)	
10b	Conventional		1.1 - 13.9	40	-11	14	44	9	21
	Conservation	5	0.4 - 11.9	11	-17	17	3	3	18
	No Till		0.2 - 9.3	21	-36	6	1	5	-5
10c	Conventional		1.1 - 13.9	40	-44	-16	44	-25	-4
	Conservation	5	0.4 - 11.9	11	-45	-8	3	-16	-7
	No Till		0.2 - 9.3	21	-70	-19	1		-24
10d	Conventional		1.1 - 13.9	40	-31	-5	44	-12	5
	Conservation	5	0.9 - 11.9	11	-33	2	3	-9	3
	No Till		0.2 - 9.3	21	-57	-9	1		-17
10e	Conventional		1.1 - 13.9	40	-101	-59	44	-82	-38
	Conservation	5	0.4 - 11.9	11	-101	-48	3	-47	-46
	No Till		0.2 - 9.3	21	-125	-55	1		-54
10f	Conventional		1.1 - 13.9	40	-86	-50	44	-67	-29
	Conservation	5	0.9 - 11.9	11	-86	-36	3	-38	-35
	No Till		0.2 - 9.3	21	-109	-46	1	-	-46
11c	Conventional		69.4 - 211.4	-	-	-	62	-48	-15
	Conservation	4	22.9 - 180.1	-	-	-	10	-49	-18
	No Till		13.6 - 140.4	-	-	-	16	-55	-30

Appendix C - Table 10 - Estimated Net Returns by Soil Resource Group and by Tillage System for MLRA 134

Kentucky

Soil Resource Group	Tillage System	T Value	Erosion Range	Net Returns: Erosion Below T: Number of Options	Erosion Below T: Range Low	Erosion Below T: Range High	Net Returns: Erosion Above T: Number of Options	Erosion Above T: Range Low	Erosion Above T: Range High
		(tons)	(t/a/y)		(dollars)			(dollars)	
11d	Conventional		69.4 - 211.4	-	-	-	62	-40	-10
	Conservation	4	22.9 - 180.1	-	-	-	10	-41	-12
	No Till		13.6 - 140.4	-	-	-	16	-47	-24
11e	Conventional		69.4 - 211.4	-	-	-	62	-104	-46
	Conservation	4	22.9 - 180.1	-	-	-	10	-104	-54
	No Till		13.6 - 140.4	-	-	-	16	-108	-62
11f	Conventional		69.4 - 211.4	-	-	-	62	-84	-35
	Conservation	4	22.9 - 180.1	-	-	-	10	-84	-43
	No Till		13.6 - 140.4	-	-	-	16	-88	-51
14	Conventional		4.5 - 6.0	-	-	-	88	12	119
	Conservation	4	1.6 - 5.2	12	32	116	4	6	76
	No Till		0.4 - 4.1	20	-2	83	4	-31	39
15	Conventional		4.4 - 6.0	-	-	-	110	-31	77
	Conservation	4	1.6 - 5.2	15	-31	73	5	-35	59
	No Till		0.4 - 4.0	25	-75	40	5	-74	20
16	Conventional		4.6 - 6.0	-	-	-	44	-61	-6
	Conservation	4	1.6 - 5.1	63	-62	-85	2	-41	-31
	No Till		0.9 - 4.0	12	-87	-31	-	-	-

Source: Compiled from Kentucky Special Resources Study data and reference reports.

REFERENCE INFORMATION

Methods of Analyses: Alternative Resource Management Systems for Cropland

Three methods are employed to analyze economic and soil conservation tradeoffs for alternative resource management systems by soil resource group. The Universal Soil Loss Equation is used for predicting annual soil loss from sheet erosion. A partial budgeting system is used to estimated the short-run value of production, costs of production, and net returns for resource management systems by soil resource group. A soil depletion model is used to estimate the long-run economic benefit a farmer could capture by converting to resource management system which reduces erosion to or below a soil tolerance or T. Soil depletion estimates are conducted for representative soils in selected soil resource groups for MLRA 134, the Jackson Purchase Area.

Universal Soil Loss Equation [1/]

Annual soil loss per acre from sheet and rill erosion is estimated by using the Universal Soil Loss Equation. The equation, developed from years of research by scientists of the USDA Agricultural Research Service, incorporates five factors which can be measured form available data. A sixth factor, the T value, is a benchmark annual soil loss rate above which soil depletion is expected to occur.

The Universal Soil Loss Equation (USLE) is expressed as A=RKLSCP, wherein:

A is the predicted soil loss;
R is the rainfall factor;
K is the soil-erodibility factor;
LS is the slope-length and slope-gradient factor;
C is the cropping-management factor; and
P is the erosion-control practice factor.

Numerical values for each of the five factors have been determined from research data. These values differ from one field or locality to another. Predicted soil loss is the calculated annual soil loss expressed in tons per acre.

[1/] Abstracted from Predicting Soil Loss Using the Universal Soil Loss Equation, USDA-Soil Conservation Service, Lexington, KY, TP-4, May 1978.

R Factors and EI Values

The R factor represents rainfall and indicates the erosivity of the rainfall in a given locality. An R factor is defined as the number of erosion index (EI) values in a normal year's rain. The erosion index (EI) value of a given storm is equal to the kinetic energy of the storm in hundredths of foot-tons per acre times its maximum 30-minute intensity in inches per hour. The EI values of individual storms may be summed to get an EI value for a month, for six months, or for any period of time. When EI values are summed and averaged over a period of years they become R factors.

K Factors

K is the soil-erodibility factor. It is defined as the rate of erosion per unit of erosion index from unit plots on a given soil. A unit plot is one 72.6 feet long and has a uniform lengthwise slope of nine percent. Unit plots are kept in continuous fallow and free of vegetation for at least two years or until all crop residues have decomposed before they are used to determine K factors. When measurements are to be made, the plots are plowed in the spring and prepared for planting crops by conventional methods. Additional tillage is used as needed to control vegetation and prevent crusting.

All tillage operations are performed up and down the slope. Naturally, soil losses from plots subjected to such treatments are among the highest that could be espected. These losses, soil by soil, are the basis for determining K factors. Soil losses from unit plots are also the basis for the soil-loss ratios used to compute C factors.

Unit plots have been established at several research centers across the country and K factors have been measured by research techniques for more than twenty major soils. More than 25 characteristics of a soil affect its susceptibility to water erosion. These characteristics may be grouped in two major categories: those that influence infiltration, permeability and total water holding capacity; and those that affect dispersion, splashing, abrasion, and transportation of soil particles by runoff. The K factors originally assigned to most soils reflect erodibility of the surface layer only. Due to increased interest in predicting soil loss from constructed sites and similar areas, K factors have been determined for different layers of a soil. A soil series may not have as many as five K factors assigned to it depending on the characteristics of its profile.

Since it is not practical to determine all K factors by research methods some factors are assigned to soils by comparing them with similar soils having measured factors. Assigned K factors are approved for each soil series by the regional principal soil correlator upon recommendations by soil scientists, agronomists, and other specialists. The assigned values are reviewed as new information becomes available and new lists of K factors are published from time to time.

LS Factor

L and S are the topographic factors in the equation. L is the length of slope factor. S is the steepness of the slope factor. L and S have independent effects on water erosion; however, in this equation they are considered together as the LS factor and their values indicated numerically as soil-loss ratios. The factor LS is the expected ratio of soil loss per unit area on a field slope to corresponding loss from the unit plot. Slope measurements start at the point where runoff begins. It ends where the slope decreases and deposition occurs or runoff enters a well defined channel that may be part of a drainage network or a constructed channel, such as a terrace or diversion.

C Factors

C is the cropping-management factor (cropland and other uses) in the equation. It is the ratios of soil loss from a field with specified cropping and management or plant cover, to that from the fallow condition on a unit plot 72.6 feet long, with a uniform lengthwise slope of 9 percent in continuous fallow, tilled up and down the slope. This factor measures the combined effect of all the interrelated cover and management variables plus the growth stage and vegetal cover at the time of the rain.

P Factors

The P factor represents the erosion control practice. The value of P is the ratio of the soil losses by contouring or contour stripcropping to up and down hill cultivation. Contouring implies that tillage operations and row grades are close to the true contour. It is most effective on slopes in the 2 to 7 percent range. As land slope decreases, the effectiveness of contour farming approaches equality and the soil loss ratio becomes 1.0. As slope increases, contour row capacity decreases and the soil loss ratio again approaches 1.0. Contouring alone will afford adequate protection against low to moderate intensity storms, but not against severe storms. For this reason, terraces and diversions are frequently used in conjunction with contouring. Contour stripcropping implies a crop rotation with alternate strips of cultivated row crops grown adjacent to strips of small grain or grass. When comparing soil losses from a system including contour stripcropping with a system of contour farming or up and down hill farming, the C factor in the stripcropping system may change. For example, the same C factor cannot be used to compare continuous soybeans on the contour with soybeans contour stripcropped because the stripcropped soybeans are in a rotation with small grains or a sod crop while the contoured soybeans are not.

Terraces reduce soil loss by breaking long slopes into a series of short ones. The spacing of terraces by means of the Universal Soil Loss Equation is determined by solving for the LS factor. Terraces intercept and hold in the field most, but not all, of the soil lost in the interval between terraces. Because some soil can be expected to leave a terraced field, a value of 20 percent of the contour P factor is used when estimating watershed sediment yields but not when estimating other soil losses.

T Values

T is the soil loss tolerance factor. It indicates the rate of soil loss in tons per acre year that will allow a high level of crop production to be sustained economically and indefinitely. Any combination of cropping and management practices which will keep soil losses at or below the specified T factor for a soil will provide satisfactory erosion control for that soil.

USLE Data

Data for the Universal Soil Loss Equation, including T values and R, K and LS factors by soil resource group for each analyzed Major Land Resource Area (MLRA), are presented in the Kentucky Special Resource Study report "Soil Resource Group for Economic and Soil Conservation Impact Analyses." C and P factors, dependent on the resource management system, are found in the same report and more detailed management system descriptions are presented in KSRS report "Resource Management Systems for Economic and Soil Conservation Impact Analyses." For each soil resource group in each MLRA, C factors are specified by rotation and tillage method and P factors are specified by soil conservation practice. Erosion rates are displayed in individual KSRS reports, "Economic and Soil Conservation Impacts: Alternative Resource Management Systems by Soil Resource Group" for MLRAs 120, 121, 122 and 134. By MLRA and soil resource group, erosion rates are specified by rotation, tillage method and conservation practice.

Partial Budgeting - Short Run

A partial budgeting system was used to analyze short-run profitability of resource management systems by soil resource group and MLRA. The underlying assumption in the partial budgeting process is that farmers are profit maximizers and the partial budgets were developed to simulate stage two of production. In stage two, a series of variable input functions exhibit dimishing returns to equal successive increments of variable inputs through reasonable expected crop yield ranges. Individual crop budgets by tillage method and soil conservation practice were linked together to form rotations. Rotations specified by tillage method and conservation practice are referred to as resource management systems (RMS). RMS analyses were conducted for each Soil Resource Group (SRG) for Kentucky MLRAs 120, 121, 122 and 134.

Component Crop Budgets

Component crops for each rotation were put through a partial budgeting process by applicable tillage methods (conventional, conservation, no till). The partial budgeting process for the Kentucky Special Resources Study was performed with the Economics and Soil Conservation Impact Calculator (ESCIC) model 1/

1/ USDA-Economic Research Service-Northeast Section, East Lansing, Michigan.

Budgets which exhibit diminishing returns through a reasonable, expected yield range on a Class I soil were created primarily using secondary data. Cost of production included in the partial budgets are:

- production inputs - seed, fertilizers, herbicides, pesticides, lime
- field operations - machinery use for pre-plant, plant, post-plant and harvest opperations
- fuel and labor requirements
- custom work
- hauling and drying
- management

Field efficiencies are adjusted by SRG to reflect relative differences in machinery operations on different soils. As a result, cost of production per unit output varies by SRG, generally being lower where the SRGs are less sloping and the suitability of soils for most kinds of farming is less restrictive or less limited.

Expected yield levels for component crops vary by SRG and tillage method. SRG yield levels were established using Soil Conservation Service productivity indicies for corn or pasture and base yield levels for the most productive (Class I) soils. Adjustments in yield by tillage for individual SRGs were made only if agronomically defensible. Since expected yields vary by SRG, expected revenues from production (yield x price) also vary by SRG

Net Returns by Resource Management System

Net returns are production revenues minus the total cost of production for a component crop. Production revenues are calculated as expected yield times price. Total cost of production is the field-efficiency adjusted cost of production plus the cost of soil conservation practices. Net returns for a component crop are specified by SRG, tillage method and conservation practice.

Net returns by RMS are constructed by matching appropriate component crops to selected rotations and annualizing. The result is average annual production revenues, costs and net returns for each RMS. The RMS is specified by crops in rotation, tillage method and conservation practice.

Average annual amortized costs of installation, operation and maintenance were developed by Kentucky's Soil Conservation Service for soil conservation practices. Practices, where appropriate, included (a) up and down plowing (no conservation), (b) contouring, (c) contour stripcropping, (d) parallel terraces, (e) tile drainage and (f) surface drainage. Amortization factors based on 12 percent interest rate and usual life of practice were used to develop amortized installation costs. Annual operation and mantenance costs were added to amortized installation costs to determine average annual costs. Production revenues, production costs and net returns by soil resource group and resource management system are presented in KSRS reports "Economic and Soil Conservation Impacts: Alternative Resource Management Systems by Soil Resource Group" for Kentucky MLRAs 120, 121, 122 and 134. The results of these impact analyses are summarized and evaluated in Chapter III, Sections 3 and 4 of this report.

Information Sources

The major data and information sources were (a) field interviews with Soil Conservation Service (SCS) and Extension Service personnel and with farmers in the Purchase Area, (b) extensive work by an economist, resource conservationist and agronomist from SCS's Kentucky state office and an economist from the Economic Research Service, (c) University of Kentucky Extension Service guidelines for fertilizer and chemical applications, (d) consultation with elevator operators and equipment dealers, (e) the Federal Enterprise Data System, (f) Economic Research Service's current normalized prices and (g) numerable comparisons with partial budgeting systems developed by universities in the states surrounding Kentucky.

Soil Depletion Estimates - Long Run

In the long-term, excess erosion can cause on-site productivity loss or soil depletion. To calculate the economic effects of soil depletion, the Soil Depletion Estimates (SDE) model was developed.[1/] The physical component of SDE was adapted from a model conceptualized by Pierce et al.[2/] The economics component of SDE was developed by the U.S. Department of Agriculture, Economic Research Service, Natural Resource Economics Division.

Physical Component

The SDE physical component was designed to utilize the Soil Conservation Service's Soils 5-Soil Interpretations Record to assign mid-point parameter values for bulk density, permeability, available water capacity and pH to individual soil horizons in a soil profile. The parameter values and texture descriptions by soil horizon are used to label each horizon as one of seven particle size (texture) classes. The texture class label relates the soil horizon parameter values directly to a set of conditions by texture class to derive sufficiency calculations for (1) bulk density with adjustment for permeability, (2) available water capacity and (3) pH. The product of the three sufficiency calculations determines the unweighted productivity index for each soil horizon.

To estimate the long-term productivity effect attributable to erosion in excess of a soil's T value, the average annual erosion rate for a specified resource management system is calculated by the user.

1/ The SDE model is documented in Kentucky Special Resources Study report "Soil Depletion Estimates".

2/ Pierce et al. "Productivity of Soils: Assessing Long-Term Changes Due to Erosion" Journal of Soil and Water Conservation, January-February, 1983.

The physical component assumes a 100 cm rooting zone for resource management system crops. Each year as erosion continues, an erosion rate dependent depth is lost from the surface and the 100 cm rooting zone slides or is incremented down the soil profile. As the rooting zone slides, the soil horizon composition in the rooting zone may change.

Each year, the model "looks" at the surface 100 cm and breaks that 100 cm into depth ranges which correspond to the upper and lower boundaries of the included horizons. If a root limiting layer such as a fragipan or bedrock is encountered such that a 100 cm rooting zone is not present, the rooting zone truncates at the soil profile's limit. If no root limiting layer is encountered, the rooting zone truncates at 100 cm.

To calculate the weighted productivity index for the rooting zone, the upper and lower boundary values for each included horizon are entered into a logarithmetric weighting function. The function decreases bounded horizon zone weights as the zones descend from the surface. The weighting function value for a bounded horizon zone is multiplied by the horizon's unweighted productivity index to derive that horizon's contribution to productivity in the rooting zone.

Each year as erosion proceeds and the bounded horizon zones in the rooting zone change, the productivity contributions of all horizons in the rooting zone are re-computed and added. The sum for any year is the weighted productivity index for that year. The weighted productivity index for any year is divided by the weighted productivity index for the first year to derive a relative index of weighted productivity. The relative index for any year is subtracted from the relative index for the previous year and the result is a slope coefficient used to calculate yield change.

Economics Component

With yield change over time modeled in the physical component, the SDE economics component uses present value and capitalization theory to compute the long-term economic impact of soil depletion. The economics component requires partial enterprise budgets for each crop in a specified resource management system. From the budgets, the user calculates the average annual cost of production (including practice costs) for the management system and establishes the initial yield levels and output prices for the management system crops. The user also specifies a discount rate for present value calculations.

Each year, the economics component calculates average annual gross returns for a management system. Yield levels from the physical component are multiplied by their respective prices for each crop in the management system, summed and annualized. With the average annual cost of production assumed constant, average annual net returns are calculated by subtracting costs from revenues.

Present value and capitalization theory can be used to derive an economic measure of benefits which a farmer can begin to capture now by controlling soil erosion to a rate less than or equal to a soil's T value. The present value of net return loss attributable to erosion is converted to an annuity, maximum agricultural expenditure for conservation practices. The maximum expenditure represents that amount of money a farmer could begin to invest in soil conservation now and continue each year in perpetuity to exactly capture the estimated present value of net return loss.

SDE Results

Soil depletion estimates were conducted for representative soils from selected soil resource groups in MLRA 134, the Jackson Purchase Area. The 12 resource management systems analyzed were the corn followed by double cropped wheat and soybeans for three tillage methods (conventional, conservation, no till) and four land utilization practices (up and down plowing, contouring, contour stripcropping, and parallel terraces). The results are presented in Kentucky Special Resources Study report "Soil Depletion Estimates: Results and Interpretations by Soil Resource Group for Kentucky's Jackson Purchase Area." The results are summarized and evaluated in Chapter III, sections 3 and 4 of this report.